DOCUMENT RESUME

ED 075 029 LI 004 182

AUTHOR	Spigai, Frances G.
TITLE	The Invisible Medium: The State of the Art of Microform and a Guide to the Literature.
INSTITUTION	ERIC Clearinghouse on Library and Information Sciences, Washington, D.C.; Stanford Univ., Calif. ERIC Clearinghouse on Educational Media and Technology.
SPONS AGENCY	American Society for Information Science, Washington, D.C. Special Interest Group on Reprographic Technology.; National Inst. of Education (DHEW), Washington, D.C.
PUB DATE	Mar 73
NOTE	38p.; (75 References)
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Computer Output Microfilm; *Librarians; Libraries; Library Equipment; Library Science; Microfiche; Microfilm; Microform Reader Printers; Microform Readers; *Microforms; State of the Art Reviews

ABSTRACT

Thirteen micrographic events have been identified which are expected to have the greatest impact on the libraries of today and tomorrow. They can be divided into two groups: Nine are of a technological nature and involve micrographic products; the remaining four are basically educational in nature and reflect positive responses from the library community to a changing micrographic technology. Most of the 13 have taken place within the past five years. Only recently have most events become powerful enough to have an individual effect on library practice. It is at this point in time, however, that a true synergy of the influence of these events is rendering the current level of library-micrographic knowledge obsolete. The 13 events to be discussed within the framework of this report are briefly presented. The author describes the many types of microforms, explains the differences between each type, and discusses the uses, benefits, and drawbacks of the various microforms. Included are a discussion of related technological events of the past decade and a list of microform equipment. Many technical terms are defined such as those describing the reproduction process of the various microform types. Also included is an annotated bibliography of the literature of micrographics. (Author/SJ)

FILMED FROM BEST AVAILABLE COPY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

ED 075029

EDUCATIONAL RESOURCES
INFORMATION CENTER

ERIC/CLIS

CLEARINGHOUSE ON LIBRARY AND INFORMATION SCIENCES

OPERATED FOR THE NATIONAL INSTITUTE OF EDUCATION BY THE AMERICAN SOCIETY FOR INFORMATION SCIENCE
1140 CONNECTICUT AVENUE, N.W., SUITE 804, WASHINGTON, D.C. 20036

INFORMATION ANALYSIS PRODUCTS

THE INVISIBLE MEDIUM: THE STATE OF THE ART OF MICROFORM AND A GUIDE TO THE LITERATURE

by

Frances G. Spigai

March 1973

IN COOPERATION WITH THE ASIS SPECIAL INTEREST GROUP ON REPROGRAPHIC TECHNOLOGY

American Society for Information Science

and the

ERIC Clearinghouse on Media and Technology

LI 004 182

ED 075029

THE INVISIBLE MEDIUM: THE STATE OF THE ART OF MICROFORM AND A GUIDE TO THE LITERATURE

by
Frances G. Spigai
Information Analyst
Oregon State University Library
Corvallis, Oregon

March 1973

ERIC Clearinghouse on Library and Information Sciences
in cooperation with the
ASIS Special Interest Group on
Reprographic Technology
Washington, D.C.
and the
ERIC Clearinghouse on Media and Technology
Stanford, California

This publication was prepared pursuant to a contract with the National Institute of Education, U.S. Department of Health, Education and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official National Institute of Education position or policy.

To Mina Jackson Gage,

A warm, loving, and adaptable mother

This paper is geared particularly for libraries and information centers.

Additional support toward the publication of this paper was given by two Special Interest Groups of the American Society for Information Science: The Special Interest Group on Reprographic Technology and the Special Interest Group on Non-Print Media.

ACKNOWLEDGMENTS

(Ed. note: During the writing of this paper, Ms. Spigai was a Senior Systems Analyst with Becker and Hayes, Inc., Bethesda, Maryland.)

The understanding attitude of Becker and Hayes, Inc. in allowing me leave to write this paper is certainly appreciated, as is the overwhelming cooperation from the staff of *MICROGRAPHICS News & Views* in allowing me the use of their extensive files and references on the subject of micrographics. Much of my micrographics education is owed to Wilbur C. Myers, with whom I have had the privilege of working for the past 18 months.

During the past few months, time was freely given to answer questions or to provide me with reference material by many people in the micrographics field: Librarians, those representing the industry, and others interested in the use of microform products. Special mention should be made of the reviewing contributions of Mrs. Kathy Block, and Messrs. Carl Spaulding, Allen Veaner and Ben Weil. Their contributions are gratefully acknowledged here and are reflected in any success this paper may have in explaining the why's, how's and what's of microfilm; the errors are mine.

TABLE OF CONTENTS

Introduction 1

Technological Events 1

- Computer-Output-Microfilm (COM) 1
- Ultra High Reduction Microform 1
- Government Printing Office Documents on Microfiche 1
- Subscriptions to Large Microform Projects 1
- The COSATI/NMA/ISO Standard Reduction Ratio (24X) 2
- Upsurge in Simultaneous and Original Publication 2
- "Cuddly" Readers 2
- Small Office Microfilming (SOM) 2
- Unitized Microforms 2

Responsive Events 2

- User Experiments 2
- *Microform Review* 2
- A National Microform Agency 2
- Library Activity in NMA 2

Microfilm: The Medium 4

- Silver (or Silver Halide) 4
- Diazo 4
- Vesicular 4

Reduction Ratio/Magnification, Generations, and Resolution 4

- Reduction Ratio 4
- Magnification 4
- *Table I. Image sizes and the number of images per fiche or per film reel for 10 reduction ratios from 12X to 250X* 5
- Generations 6
- Resolution 6
- *Figure 1. NBS 1010–A Microscopy Resolution Test Chart* 6

Microformats 7

- Roll Microfilm 7
- Microfiche 7
- *Figure 2. NMA Format* 8
- *Figure 3. Old COSATI Format* 9

Microform Content 10

- Simultaneous Publication and Microform Leasing 10
- Original Publishing 11
- Newspaper Indexes 11
- Ultrafiche Libraries 11
- Packages 12
- Miscellaneous: Census Data, Library Cataloging Data, Equipment Catalogs 12
- Guides to the Identification and Acquisition of Microforms 12

Notes and References 14

Microform Equipment: A Guide to the Literature 17

Containers and Storage Equipment 17
Figure 4. Microfilm Containers 17
Readers and Reader-Printers (R/P's) 18
Retrieval Equipment 20
Table II. Characteristics of sample microform retrieval systems 21
Small Office Microfilm (SOM) Equipment 22
The "Cuddlies" 22

User Studies—A Selected Survey 23

Subjective Afterthoughts 27

A Selected Guide to the Micrographics Literature 29

Monographs 29
Primers 29
Annuals 29
State-of-the-Art Reviews 30
Journals 30
Information Services, Newsletters, Current Awareness Services 30
Abstracts 31
Glossary 31
Standards 31
Sources of Information and Consultants 31
Market Research Studies 31

INTRODUCTION

Librarians were formally introduced to microfilm some 36 years ago.[1] Except for Readex Microprints(R), 3" x 5" microcards, and isolated appearances of the aperture card, librarians had little to contend with but 35mm reel microfilm until the mid '60's. An astounding number of significant microform events have occurred or evolved since 1964.

Indeed, if microfilm's impact on the library were divided into periods of six years each (since 1936), the first five periods would have to be considered the dark ages (no pun intended). The period just ended might best be characterized by the words "product proliferation." And the current period (e.g. 1972 on) appears to be one of response—response to the growth, variety, profusion and confusion of product proliferation—response through more vocal library committees and closer liaison with industry, through fruition of industry standards, and through the inevitable proliferation of information to describe, organize and analyze microform developments. A discussion of events evolving and occurring during the last two periods should explain why the library or information center administrator has a right to be in future shock about microforms.

Thirteen micrographic events have been identified which are expected to have the greatest impact on the libraries of today and tomorrow. They can be divided into two groups: Nine are of a technological nature and involve micrographic products; the remaining four are basically educational in nature and reflect positive responses from the library community to a changing micrographic technology. Most of the 13 have taken place within the past five years, a few had commercial introduction from six to ten years ago, and two fall into the newborn and prenatal classes. Only recently have most events become powerful enough to have an individual effect on library practice. It is at this point in time, however, that a true synergy of the influence of these events is rendering the current level of library-micrographic knowledge obsolete. The 13 events to be discussed within the framework of this report are briefly presented below.

TECHNOLOGICAL EVENTS

Computer-Output-Microfilm (COM)

This technology has made it economically possible for commercial micropublishers to issue bulky indexes, catalogs and data files on microform.

Library records (catalog records, accounting information, circulation records) are being converted to digital (machine-readable) form. In libraries where distribution is to many locations, this information has been most economically micropublished using COM equipment.[2]

Ultra High Reduction Microform

Until 1970, libraries were concerned with microfilm reduction ratios from 12X to 24X. Now ratios up to 150X are being used for library materials; a 3500-volume "library" is being sold in two loosely-packed 4" x 6" file drawers.[3]

Government Printing Office Documents on Microfiche

Depository libraries will have the option of receiving government documents on either 24X microfiche or in printed form beginning in 1973. Specifications for bidders (microprinters who will supply the GPO with master and distribution fiche of all government documents currently sent to depository libraries) are being drawn up.

Subscriptions to Large Microform Projects

Subscriptions to microform collections which have relatively wide appeal and which are complete with bibliographic support tools are vying for a large part of the librarian's resource budget. Examples of these projects are the ERIC (Educational Resources Information Center) collection, which appeals to a large audience of educators; and the *Congressional Information Service*, useful to

anyone researching U.S. government legislation. The ultrafiche collections mentioned above are also examples of this trend (e.g. Encyclopaedia Britannica's *Library of American Civilization*).

The COSATI/NMA/ISO Standard Reduction Ratio (24X)

It has been pointed out that COSATI requirements were based upon U.S. Government reports produced in typescript. Though a National Bureau of Standards report has suggested 12X as the maximum first-step reduction ratio for documents with fine detail and small character sizes, only a project to republish National Library of Medicine documents heeds this advice. Otherwise, 24X appears to be the accepted standard.

Upsurge in Simultaneous and Original Publication

More current, widely used, commercial publications are becoming available on microform (e.g., monographs from University presses, primary and secondary periodicals from professional societies) at the same time as the printed versions or with more information than the printed version.

"Cuddly" Readers

The cry for an inexpensive, portable reader, as comfortable as a book, was made popular by Harold Wooster.[4] Since then, Office of Education money sponsored the DASA reader, which retails for $89.50 and weighs less than 5 lbs. A number of similar models at similar prices followed. At last year's National Microfilm Association Convention, two high quality readers were priced under $100: Kodak's Ektalite and Bell & Howell's Briefcase model.

Most remarkable is a truly revolutionary new development which may result in $5, book-size, microfiche readers and "book-page size" fiche which contain up to 625 images at 24X and may sell for as little as 25c apiece.[5]

Small Office Microfilming (SOM)

Systems made up of inexpensive equipment for every phase of microfilming production, duplication, storage and retrieval are now being put together for offices where only a modest amount of microfilming or retrieval of modular microform collections is necessary. These could also apply to many small-to-medium libraries, information centers and central file centers.[6]

Unitized Microforms

Though the introduction of unitized microforms to the library was later than that of roll microfilm, fiche seem to be taking over every area but newspapers. Will the advent of better motorized, cartridge-loaded reader-printers and the recent trend toward primary and secondary journals on 16mm microfilm force the pendulum to swing back to roll film?

RESPONSIVE EVENTS

User Experiments

How do people use microforms? More and more user experiments are trying to answer this question. The answers may not be right, but conclusions are being drawn, and recommendations based on these conclusions will affect reader and micropublication design for years to come.

Microform Review

This is a new, polished journal which provides critical reviews of micropublications, a medium of exchange for those responsible for library microform collections, and substantive articles specific to library interests.[7]

A National Microform Agency

There is a widespread recognized need for a national microform agency to serve the library community. Denver Research Institute made an attempt to start up an Organization for Micro Information beginning January 1972. Lack of subscription support, and lack of grant support stifled OMI. The Association of Research Libraries may seek money for a similar organization, yet to be formed.[8] Meanwhile ALA's Library Technology Project, which publishes evaluations of microform equipment and functions as a general source of library/microform information, has been cut back drastically.

Library Activity in NMA

The first non-geographic "special interest group" of the National Microfilm Association was established last year: The Library Relations Committee. Chairman is Carl Spaulding of the Council on Library Resources. Last year's NMA President, Milton Mandel of Research Publishing Corp., appeared determined to make NMA a society which communicates with librarians. In turn, NMA ears will be receptive to reasoned response from the library community.

* * * * *

The remainder of this paper will deal with microfilm and microfiche formats in three sections. The first section covers four aspects of micropublication: (1) Microfilm as a medium, (2) resolution, reduction ratio/magnification, and generations, (3) the formats of microfilm, and (4) the content of present-day microforms. The second section provides an overview of the equipment and of guides to the equipment available to handle processed microfilm: Storage equipment, duplicating equipment, readers, reader-printers, and retrieval equipment.

A round-up of user studies, some "subjective afterthoughts," and a select guide to the micrographic literature form the final section.

This paper will focus on the acquisitions of commercially published microforms by libraries and information centers. It will not attempt to deal with details of in-house microfilming projects undertaken by some libraries and archives, since, by comparison, this appears to be of limited interest.

One important area not covered in this paper, which also enjoys a large void in the literature, is that of handling and maintenance problems with microforms. Although the author was interested in this aspect, lack of first-hand experience with large collections in many formats used by many patrons, coupled with the dearth of useful literature on the subject, prompted its exclusion.

MICROFILM: THE MEDIUM

There are three main types of film used in micropublication today.

Silver (or Silver Halide)

The name comes from the emulsion layer (or image-producing material) used, since the light-sensitive materials used in silver emulsions are made up of chlorides, bromides and iodine—all halides. The important facts to remember about this type are that it is the dominant material for original microfilm recording and it is the only microfilm material for which archival tests and standards have been established.[9]

It is used for distribution copies, as well as for originals, in the library and publishing fields where archival quality is required. Silver film was originally a sign reversal medium—it would produce negative images for the master film copy (first generation). The second generation, a silver copy of the master, would be a positive, and so on.

Williams[10] discusses a non-reversal silver film which is commercially available and quite widely used today. The development process for silver microfilm is essentially the same as that used for standard silver camera film (i.e., a wet process in a "dark room"). Distribution copies on silver microfilm are usually more expensive than diazo or vesicular copies.

Diazo

Diazonium salts, mixed with chemical couplers and acid stabilizers, form the base of diazo film. Diazo film is processed using ultraviolet (UV) light, heat and ammonia. When a diazo material in contact with a transparent or translucent original is exposed to UV light, the transparent portions allow UV light through to the diazo film. The UV light transforms those diazonium salts under the transparent portions to a fixed colorless compound. In the exposure process, ammonia vapor converts the unexposed portions of the film to a dark azo dye, thus creating a direct copy (i.e., wherever the original is dark, the diazo copy will be dark; wherever the original is transparent, the diazo copy will be transparent).

Since diazo is only sensitive to UV light, it can be processed in ambient light (ordinary, room light). Diazo is not currently certified to have archival quality. The stability and keeping characteristics of both diazo and vesicular films are due to be tested by the American National Standards Institute Subcommittee PH 1-3.[11] Results of these tests should provide a guide for microfilm consumers in the future.

Although diazo produces direct copies, there have been reports of a reversal diazo film.[12] Diazo is said to be less susceptible to damage and scratching, and less liable to damage from heat than silver film.[13] It is known for its high resolution qualities and is used extensively for distribution copies where archival quality is not required.

Vesicular

Vesicular film is the newest of the three films, having been introduced by Kalvar in 1956.[14] Vesicular, like diazo film, is processed by heat using ultraviolet light. But the film development process is more physical than chemical, and two exposures are necessary to fix image permanence. This film derives its name from the bubbles or "vesicles" that are formed by the action of UV light on diazonium compounds in a crystalline plastic emulsion. A second exposure to UV light pressurizes remaining crystallite gas particles, which escape from the emulsion during the cooling stage so that only the bubbles are left. The vesicles form the image by scattering light away from the eye; this is interpreted as a dark area. While most commercial vesicular films reverse sign, like silver halide, there have been some special applications of direct image production using vesicular films. These vesicular films require exposure and development processes similar to those for silver halide film.

Storage problems, traced to the corrosive action of hydrochloric acid on metals, have been experienced by libraries which house their Kalvar films in metal containers and file cabinets. The company advises storage in plastic containers. Xidex, Inc. is another producer of vesicular film; they claim their film does not have these storage problems.

REDUCTION RATIO/MAGNIFICATION, GENERATIONS, AND RESOLUTION

These terms are trouble-makers. Not because they're difficult to understand, but because even basic microfilm texts consider them too basic to go into.

Reduction Ratio

Reduction ratio is defined as the ratio of the linear measurement of the document to the linear measurement of the microform image of that document. The ratio is commonly expressed as 20:1 or 20X for a document which has been reduced to an image 1/20th of its original size. As Table 1 shows, an 8½" x 11" page which has been reduced 20 times yields an image 10.8mm x 13.9mm. A total of 72 frames (6 rows by 12 columns) would fill a 4" x 6" microfiche, or over 2700 frames would fill a 100 foot long roll of microfilm.

Magnification

Magnification, or the blowback ratio, is a measure of the power of the lens or lenses in a microform reader

TABLE 1. Image sizes and the number of images per fiche or per film reel for 10 reduction ratios from 12X to 250X

At reduction ratio:	The image size would be (width x length):	The image to scale	No. of images (pages) per 4" x 6" fiche*	Rows by Columns	Approximate no. of images 100 ft. roll of film (comic mode)**
12X	18 x 23.3mm		32	4 x 8	1,650
18X	12 x 15.5mm		72	6 x 12	2,500
20X	10.8 x 13.9mm		72	6 x 12	2,750
24X	9 x 11.6mm		112	8 x 14	3,300
42X	5.1 x 6.7mm		392	14 x 28	5,850
48X	4.5 x 5.8mm		**527	17 x 31	6,600
90X	2.4 x 3.1mm		**1,856	32 x 58	12,500
150X	1.44 x 1.6mm		**6,138	62 x 99	20,800
210X	1 x 1.33mm		**10,582	74 x 143	30,000
250X	.86 x 1.12mm		**14,685	89 x 166	34,600

* This page is 8½" x 11" (or, expressed metrically, 216mm x 279.4mm). Pages larger than 8½" x 11" would require larger images at the same reduction ratios. The number of images that can fit onto one microfiche depends on the reduction ratio used, the size of the microfiche or the length of the roll film, the size of the original page, and the amount of space given to margins, headers and spaces between images (i.e., non-image space).

** Ample space between images, especially in the higher reduction ratios and in roll microfilm, would tend to make these capacities impractical, but the table allows an idea of the comparable saturated capacities of the above reduction ratios for 4" x 6" fiche and 100 ft. long roll film.

to enlarge an image. This ratio is also expressed as 24X or 24:1. If a page is originally 8½" x 11" and it is reduced 24 times and displayed on a reader with a 24X lens, then the reader screen image will be the size of the original page: 8½" x 11". If the page is reduced 24 times and displayed on a reader with a 20X lens, the size of the screen image will be 5/6 of 8½" x 11", or:

$\frac{M}{RR}$ (O) = I, or 20/24 (8½" x 11") = 7" x 9.2" where

M = reader magnification, RR = film reduction ratio, O = the original page size, and I = screen image size.

Generations

The first microform copy of the original document is called the "master copy," or the "camera copy," or the "first generation copy." Usually the master copy will be stored away for safekeeping after a copy has been made from it. This is called a second generation copy. It is usually used to mass produce distribution copies. The copies made from the second generation copies are third generation, and, like families, so it goes. For example, paper prints from distribution copies are fourth generation. Each generation experiences a loss in resolution (perhaps 10%).

The standard is that the resolving power of each generation can be no more than one NBS pattern less than the preceding generation. Veaner presents a good treatment of film generations and polarity.[15] He concludes that since " . . . any generation of film can be either positive or negative" with reversal processing " . . . film polarity under no circumstances can be used as a reliable guide to estimating the 'generation' of a film, except by the very experienced photographic technician . . . "

Resolution

Resolution is a measure of the ability of microfilm to record detail. This is determined by how well closely-spaced, fine lines are recorded. Camera lenses also have a resolving power: The ability to record (on film) fine lines, closely-spaced. And finally, microfilm readers or reader-printers, in focusing on the screen the projected image of the processed microfilm, exhibit yet another resolving power, related to their lens system, mirrors and the screen—the resolution of the image on a reader screen.

The National Bureau of Standards 1010A Microcopy Resolution Test Chart (Figure 1) is used to measure resolution in the United States. The current edition has 26 patterns in decreasing size. Each pattern is made up of two sets of five black lines, separated by blank spaces of equal width. Each black line and blank space are considered a line pair. A line pair in the pattern numbered 1.0 is one millimeter in width. A line pair in the pattern numbered 10 is 1/10 of a mm wide; a resolution of 10 lines/mm is needed to distinguish line direction in this pattern. Resolution is measured in lines per millimeter (meaning the black lines in this case). Librarians should be concerned with the resolution of the film product they purchase and the resolving power of the reader they use.

The standard means of determining the resolution of processed film is to view the NBS resolution chart (which has been filmed onto the film) through a 50X-150X microscope. The smallest pattern in which line pairs or their direction can be distinguished is noted (e.g., 5.6). The resolution is then calculated by multiplying the reduction ratio of the film (e.g., 20X) by the pattern number: 5.6 x 20 = 112 lines/mm. What exactly does this value mean; is this good resolution or poor? Williams[16] mentions that "the normal human eye is considered to be capable of resolving up to 10 line pairs per millimeter (for a full-size image)." Nelson[17] presents us with the following rule of thumb: "With full-size print reproductions, a general guide is that resolution of 3 lines per millimeter gives poor quality, 4 lines per millimeter acceptable quality, and 5 lines per millimeter good quality." On the other hand, a National Bureau of Standards study[18] set 8 lines per millimeter as the desirable resolution goal for third-generation film for a library microfilming project where character sizes were less than 1 mm high.

Resolution values vary directly with the reduction ratio. As Williams[19] puts it: "A 6 point type at normal viewing distance requires a resolution of 4 lines per millimeter; at 1000 reduction, 4,000 lines per millimeter are therefore required to restore 4 lines per millimeter to an original scale copy." Therefore, film reduction ratio

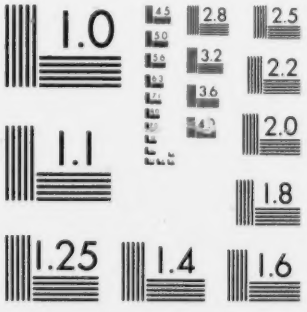


Figure 1. N B S 1010-A Microscopy Resolution Test Chart

(RR) is related to processed film resolution (R_F) in the following simple expression: RR x P = R_F (e.g. 20 x 5.6 = 112 lines/mm) where P is equivalent to the smallest test pattern value distinguished (e.g., 5.6). To determine image resolution (R_I), the film reduction ratio (RR), and the reader magnification (M) relate to each other as follows: $\frac{RR}{M}(P) = R_I$ (e.g., $\frac{20}{24}(5.6) = 4.7$ lines/mm in a system where the images were filmed at a reduction ratio of 20, reader magnification is 24, and the smallest pattern distinguished is 5.6). At 4.7 lines/mm the image resolution is acceptable to good quality (15). However, the ultimate subjective test is, as Veaner[20] points out, "Are the images readable?"

MICROFORMATS

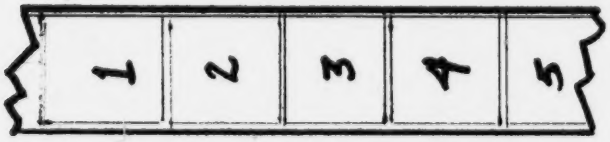
Microfilm is distributed in two basic forms: Roll and flat. Within each of these, there are several combinations of frame and form sizes and frame orientations.

Roll Microfilm

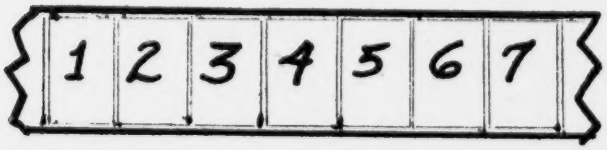
Roll microfilm is a roll of microfilm. For library purposes it is usually 100 feet long and 16mm or 35mm wide (.64 inches or 1.4 inches). The first few inches are usually blank, except for brief information identifying the contents of that roll; this is the leader portion. The informational portion consists of frames containing text, pictures or other information. Page images are photographically reduced and typically occupy one frame of the roll. Frame sizes usually approximate the width of the film (i.e., 16mm or 35mm). However, a new frame size for roll film, 8mm, is rapidly assuming many COM and SOM applications, and sometimes two columns of 8mm images are filmed onto a 16mm roll, although 8mm cassettes also are being sold.[21]

Orientations for frames on roll microfilm fall into two basic categories: Cine and comic.

- Cine. Frames using this orientation are in one long column of (sideways) images as on motion picture film.

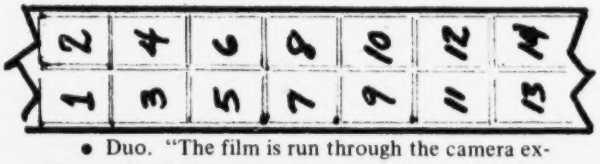


- Comic. Frames are positioned in comic-strip panel sequence, and comprise one long row of images.

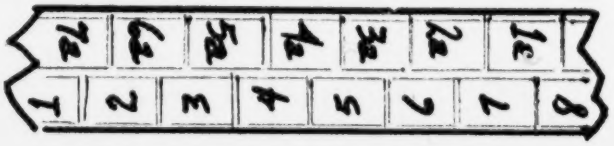


Duplex and duo are two additional layouts which contain two columns of frames per roll:

- Duplex. The front and back of pages in a document are photographed simultaneously and arranged side by side on a roll of film.



- Duo. "The film is run through the camera exposing one-half of the film. On completion, the full take-up spool is removed, flipped over, then placed back in the load position, threaded and run through the camera a second time . . . " thus taking ". . . pictures on the remaining unexposed side."[22]



Reduction ratios used in the past for library roll film products fall into the 15X-20X range. Most newspapers with oversized pages (about 15 inches wide by 24 inches long) fit comfortably in cine mode on 35mm roll film if filmed at 18X. In the past, periodicals were sold on 35mm rolls, most commonly at 18X. Journals have recently been issued on 16mm microfilm, at reductions from 18-24X.

Microfiche

Microfiche is a flat, transparent sheet containing frames of microfilmed images. Frames are arranged in rows and columns. The standard microfiche is four inches long by six inches wide (105mm x 148.5mm) and consists of a header portion, identifying the contents of that fiche or of the set of fiche making up that title, and the information portion, which contains the individual frames of text (or of other information). Some sets have the header on every microfiche of the set. Others have it only on the first microfiche of the set; each trailer fiche contains the fiche sequence number (e.g., 2 of 3, 4 of 7, etc.) and the identification number in the first two frames.

Microfiche has been more fickle with respect to reduction ratios, and consequently, frame sizes. The principal reduction ratios used by libraries today are 18-20X and 24X (medium-reduction), 40-44X and 48X (high), 55-90X (very high), and 115-150X (ultrahigh). A comparison of image sizes, grid sizes, and the approximate number of images which can fit into a 4 inch by 6 inch space appears in Table 1. Figure 2 shows the grid area coordinates and arrangement of information on the first microfiche of a set for the NMA/COSATI standard used for government research reports. Figure 3 shows the relation of first and trailer microfiche for the old COSATI standard.

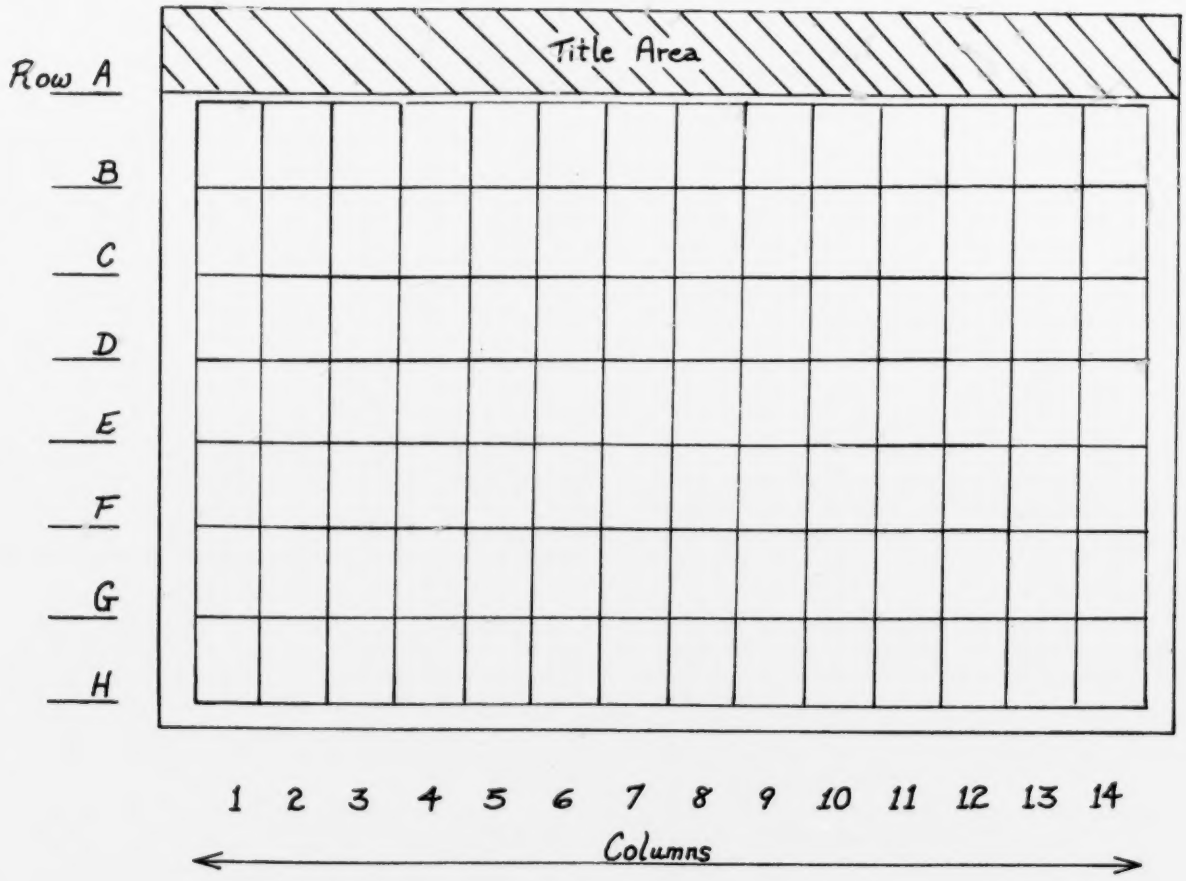
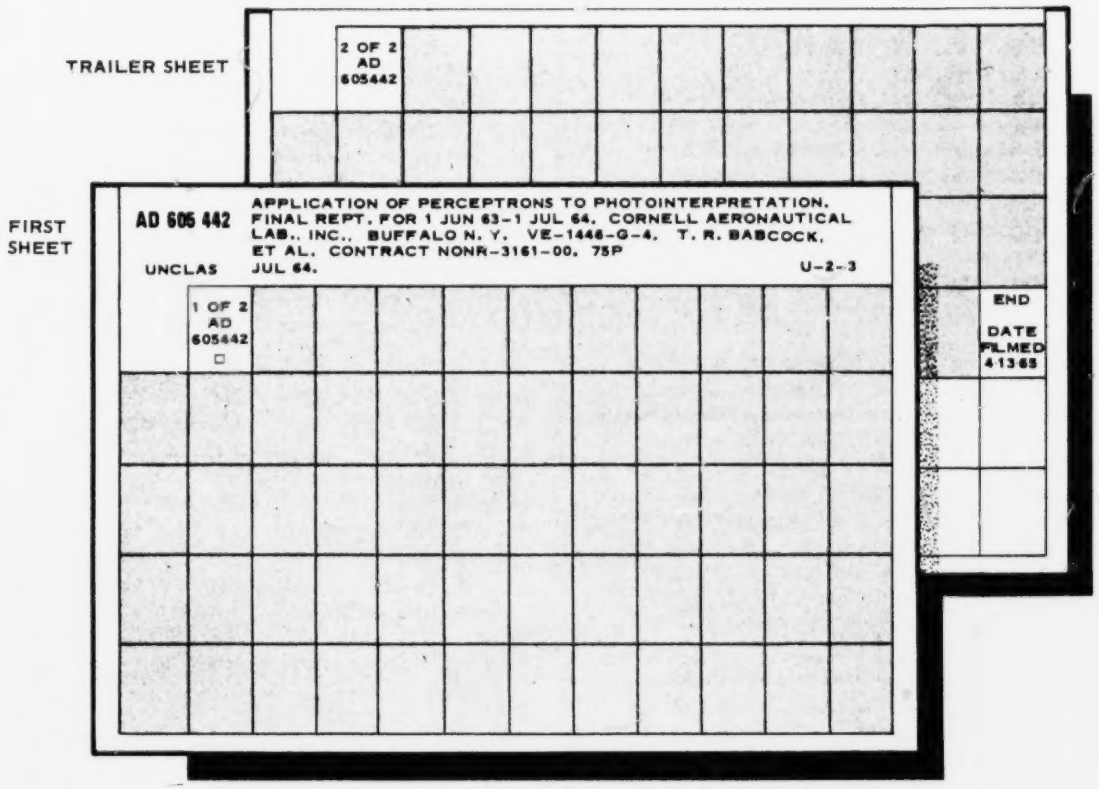


Figure 2. NMA Format. This format is now an American National Standard. The Committee on Scientific and Technical Information (COSATI) and DOD adopted this standard for Federal Government use in 1971. It is designed to house 98 images (7 rows x 14 columns)—of 8½ x 11-inch pages which have been reduced to 1/24th of their original size (i.e., 24X)—on 4" x 6" microfiche sheets. Annotated illustrations of 11 standard microfiche formats can be found in a handy 12-page booklet: *The User's Guide to Microfiche Formats* by Don Avedon. Available for $3 from Microfilm Publishing, Inc., P.O. Box 313, Wykagyl Station, New Rochelle, New York 10804.



RELATION OF FIRST AND TRAILER MICROFICHE SHEETS

Figure 3. Old COSATI Format. This is the format which is being phased out by COSATI and DOD after more than five years of use; retrospective collections will still contain this format, of course. It was designed to house 60 images (5 rows x 12 columns)—of 8½ x 11-inch pages reduced 20X—per fiche. The second and subsequent sheets contain one additional row of images in place of the title area, for a total of 72 images per trailer sheet. The first two frames of each microfiche sheet are used for identifying (vs. text) information. The small square shown in the second image location is where the NBS resolution test chart appears. [Figure reproduced from PB 167730, p. 13.]

The decision to microfilm onto roll or fiche format or to purchase film or fiche, if there is an option, depends on many conflicting factors which seem to boil down to two main categories: Economy and ease of use. Some of the factors are:

- Length of the original publication. Government agencies chose microcards and microfiche because a good portion of the documents to be filmed would fit onto one or two microforms and individual reports could be distributed most economically in this form. The Government Printing Office contends that 85% of the government documents to be filmed at 24X will fit onto one microfiche. Also a roll of boxed microfilm would take up nearly as much shelf space as publications up to 300 pages long.
- Frequency and timing of microform distribution. Fiche is probably best for issues of periodicals distributed at the same time as printed issues; however, backfiles of periodicals, comprised of many issues, are most economically packaged on roll microfilm.
- Philosophy on sets. Could *The New York Times* be microfiche issues of 365 separate newspapers? Or 52 Sunday editions and 313 daily editions? Or is it whatever time period will fit onto a 100-foot-long 35mm roll? (e.g., July 3-Sept. 2, 1903—in 1903 daily issues of *The Times* were only 16 pages long!)

The philosophy is mostly determined by user needs. If backfiles of newspapers and periodicals experience only occasional use then the more economical means of storage is justified. Replacement costs may be higher with microfilm though, since whole reels have to be purchased.

- File integrity. Microform reels assure file integrity, but lack of labelling on individual reels can create re-filing problems. Microfiche are a file gremlin's dream. Just file one incorrectly, try to locate it, and the problem will soon become apparent.
- Indexing mechanisms and automated readers. A search through roll microfilm can be pretty time consuming. However, coding systems on the film and readers or reader-printers which can use the coding schemes can greatly speed access.[23,24]

For those who'd like a firsthand look at samples of the different types of microform, Dataflow Systems, Inc. of Bethesda, Maryland has assembled a Demonstration/Sample Microform Kit for $4.95. Each kit includes aperture cards, microfiche, superfiche, ultrafiche, 16mm microfilm (with bar, blip, and binary coding), 35mm microfilm, etc., complete with written descriptions for each.[25]

MICROFORM CONTENT

One of the most frequent criticisms leveled at micropublications is that out-of-print items, informal government research reports, backfiles of periodicals, and rare documents are all that is available on microfilm. Times are changing!

Simultaneous Publication and Microform Leasing

There is a growing trend toward simultaneous publication in microform and print. The University of Toronto Press has been publishing new books in both microfiche and hardcopy since early 1971. The Press supplies 24X positive images on silver (archival quality) microfiche. Fiche copies are ordered and invoiced like books and retail at hardcopy prices.[26] Following suit, the University of Washington is offering either fiche (20X negative diazo) or hardcopy versions of its books. Hardcopy and fiche prices are identical. A sample 64 titles listed for both publishing houses shows that over 80% of the titles are accommodated on 5 fiche or less (i.e., less than 480 pages). Prices typically range from $7-$15 for these titles, with the average close to $10.

If fiche duplicating machines approach the popularity of copying machines, the copyright problem could become even thornier with the proliferation of relevant, timely publications on fiche. Coin-operated fiche duplicators would certainly be able to turn out copies at less than a quarter a sheet, enabling library patrons to obtain copies at about 10% of the retail cost of the publication. Perhaps pricing film and hardcopy alike isn't realistic to begin with—at least for textbooks, where the total unit, versus select pages, may be of interest and cheaply copied. It would be interesting to determine how many purchasers select fiche over hardcopy at identical prices. Butterworths of London is also reported to be considering simultaneous publication of its legal and scientific books.

Simultaneous publication is also making news in the area of periodicals. Pergamon Press issues microfiche or microfilm (only to subscribers to the printed editions) of any Pergamon journal. Fiche contain 60 pages, are silver halide, positive or negative, and sell at the same price as the printed copies. *Microform Review* appropriately makes its issues available on microfiche at the same time as the printed version. IEEE journals and the new publication *World* are additional old and newcomers to the simultaneous publication scene.

A new trend in retrospective primary journal micropublication is typified by *Current Physics Microform*, a new program covering some 34 journals of the American Institute of Physics. Monthly editions of *CPM* are distributed on three or four 16mm reels or cartridges that contain about 8,500 pages a month. Companion index services (*Current Physics Titles* and *Searchable Physics Information Notices*) refer to microfilm reel and frame number as well as hardcopy volume and page number for rapid access. *CPM* is available on lease (at $2850) and allows subscribers to make copies

of articles as part of the lease agreement.

A similar service, begun even earlier, is offered by the American Chemical Society: *ACS Primary Publications on Microfilm.* Microfilm and hardcopy versions of twenty-one journals can be leased for $7700 for complete sets from Volume 1 to date, or for $1582 for current years. Journals are available on 16mm cassettes, with an option of four types of roll indexing available.

Secondary publications, for example *Chemical Abstracts* and *Engineering Index,* are also available for lease on roll film. *EI* offers both 16mm and 35mm microfilm. Crowell Collier McMillan's Pandex features fiche! The right to make hardcopies from many of these publications is included as a feature of the lease.

Probably the most popular example of simultaneous publication can be found in the distribution programs for reports on government-sponsored research. The Atomic Energy Commission, the Department of Defense and the Department of Commerce's National Technical Information Service (NTIS) were issuing microcards and microfilm in the 50's and early 60's. The change to fiche came in 1963/1964. Three years later, the Office of Education based the microform programs of its new Educational Resources Information Center entirely on fiche. With the addition of ERIC, the fiche revolution was really on! Most reports of government-sponsored research which are publicly available are available on fiche.

Original Publishing

Original publishing in microform is hardly a new concept. Many valuable collections of papers, documents and studies have been compiled, edited and issued in microform. Usually the collection is of limited appeal (perhaps of interest only to research libraries) and voluminous enough so that the only economical means of publication and distribution is via microform. In today's microform market however, an old concept is being practiced and a new one being explored by periodical publishers. The American Society for Information Science has long maintained a service allowing editors to deposit with the Society the full text and supporting material of lengthy articles. Shortened versions are published which refer to a National Auxiliary Publications Service identification number. At this Service, the material is microfilmed and stored for later inquiries. Although this isn't the most used service in the world, it is one predecessor to the projects discussed below.

The American Chemical Society's Primary Publications on Microfilm project already includes more than 2,000 pages of text, figures, table and references in the microfilm edition which are not found in the printed version—a nice incentive to "go microform."

Meanwhile, Europe has unleashed the concept of the "synopses journal."[27] Full papers would be stored on microfilm. One page, front and back, would contain bibliographic information on the full paper, an abstract, postal address of the authors, and non-text material (figures, tables). These two pages would be the only "published" version of the paper. The microform version would reside in university and institutional libraries and could be hardcopied on demand.

An innovative idea in micropublishing debuted in 1971 in the guise of a book. A volume measuring 9" x 7" x ¼" contains on several microfiche the entire contents of a book. The fiche are inserted into pockets on the inside back cover of the book. Each volume also contains printed material which is bound into the volume: title page and verso, table of contents, index and any other pertinent data not found in the main microfiche text. Volumes are sold at a uniform $6 apiece by Microtext Library Services, Inc., a division of James T. White & Co. The primary stumbling block to acceptance appears to be content: Some of the books are still available in hardcopy—some at low cost; others have very limited appeal.[28]

Newspaper Indexes

Two newspaper products of recent years illustrate the trend toward compiling, selecting, condensing and indexing. *Newsbank Urban Affairs Library*[29] provides on microfiche clippings from 150 newspapers published in 103 cities. The microfiche, as well as a loose-leaf index to the clippings, are updated monthly. Yearly subscriptions are $996 from Arcata Microfilm Corp. Bell & Howell's *4 in 1 Newspaper Index*[30] has received a positive response from the library community. At $785 a year, in-depth indexing of *The Chicago Tribune, The Los Angeles Times, The New Orleans Times-Picayune* and *The Washington Post* is provided on a quarterly basis. The newspapers also are available on microfilm from Bell & Howell.

Ultrafiche Libraries

Several huge collections, mostly of out-of-print monographs and geared to college and research libraries, have been published on high and very high reduction microfiche. Encyclopaedia Britannica and The National Cash Register Company are the culprits, or saviors, depending upon your viewpoint. These ultrafiche collections and the general subject of ultramicrofiche for libraries have been reviewed extensively elsewhere.[31,32] A forthcoming survey of users of these collections, to be published by *Microform Review,* should provide even more grist for the mill. Briefly, the significance of these collections boils down to several main points; positive or negative aspects would have to be decided by each potential customer:

- A large number of publications are made available

at a low cost per volume (e.g., 500-20,000 volumes at $1.05-$1.70 per volume). However, later collections like Encyclopaedia Britannica's *Library of English Literature* cost considerably more per volume.

- Library of Congress card sets (10,000-40,000 cards) are available, as are book catalogs and indexes–with various degrees of usefulness.
- Most titles are pre-1914; relevance and selection criteria should be studied. However, many rare titles are available through these collections.
- Special equipment is needed to use the products of the two manufacturers.
- Space savings over printed volumes are huge.

Packages

Other collection "packages" not in high reduction microfiche are favorably represented by the Microfiche Library of Congressional Information Service (CIS), Washington, D.C.[33,34] All Congressional working papers (except the Congressional Record) are offered in the form of a handily-packaged set of microfiche, ready to use and complemented by a highly-acclaimed index.

CIS and other companies who micro-republish government documents in the public domain feel threatened by recent decisions of the Government Printing Office to offer these same documents on microfiche free to depository libraries. Although the documents offered by the GPO would require a large amount of assembling and arranging by librarians to approach the convenience afforded by collections such as the CIS package, tight library budgets might force some libraries to opt for the GPO fiche. The controversy between micrographics industry representatives and the government has been covered in a series of articles appearing in *MICROGRAPHICS News & Views.*[35] The story is a continuing one since there won't be a precise GPO program before 1973.

Miscellaneous: Census Data, Library Cataloging Data, Equipment Catalogs

A sampling of other information available in microform reveals census data,[36] library cataloging data,[37] equipment catalogs,[38] and a select number of commercial surprises and old standbys. The last are too numerous to detail, but interesting to list: Musical scores, Far and Near Eastern language dictionaries, bibles, college catalogs, audio recordings, patents, 1,000 photos of Harry S. Truman, stock reports, advertisements, construction specifications, doctoral dissertations, theater arts collections, and a self-contained data-retrieval system for stocks on microfiche transparencies.

Guides to the Identification and Acquisition of Microforms

Some documents listed in this and following sections are available from ERIC. To order any of them, note the listed price, and enclose a check for that amount to the ERIC Document Reproduction Service, P.O. Drawer O, Bethesda, Maryland 20014. Always order by ED number. Individual Clearinghouses cannot fill these requests.

* * * * *

The identification and acquisition of microforms is a subject of much concern. Here are some samples of available guides and what's being planned.

A handy round-up, useful for its discussion of acquisitions procedures and equipment, can be found in:

Roma S. Gregory, "Acquisition of Microforms," *Library Trends,* Vol. 18, No. 3, pp. 373-384, January 1970.

Several publications announce micropublications or micropublishing projects. Three of the most comprehensive and useful are:

The National Register of Microform Masters, 1970, Catalog Publication Division, Library of Congress, Washington, D.C., 1972, $12.50. Permission was granted to copy purpose and scope information from the introduction to the 1970 edition. It is presented below.

> *"The National Register of Microform Masters* is intended to serve both as a complete listing of masters from which libraries may acquire prints and as an aid to libraries in identifying those microform masters that meet the requirements for preservation. Two categories are listed in the Register:
>
> 1. Master microform:
>   a. A microform used only to make copies and
>   b. from which single copies are available at any time and for a reasonable price.
> 2. Master preservation microform:
>   a. A master microform that is housed in a temperature-controlled, fireproof space and
>   b. owned by a nonprofit institution.
>
> Microform masters listed in this publication must meet the specifications of the American National Standards Institute in regard to film quality and permanence and should, if possible, meet the requirements for completeness, collation, image placement, reduction ratio, target, etc., as set down in the current specifications for microfilming published by the Library of Congress.[39]
>
> The *Register* includes entries for foreign and domestic books, pamphlets, serials, and foreign doctoral dissertations but excludes technical reports, typescript translations, foreign or domestic archival manuscript collections, U.S. doctoral dissertations, and masters' theses."

Newspapers on Microfilm. The sixth edition, 1967, is out of print; completion of the seventh edition was predicted for the end of 1972. Available from the Catalog Publication Division of the Library of Congress, Washington, D.C. "A cumulative bibliography of microform masters and service microforms of American and foreign newspapers, reported by U.S. and Canadian

libraries or held by American and foreign commercial microfilm producers." (Description taken from *LC Catalogs in Book Form and Related Publications.*)

Albert J. Diaz, editor, *Guide to Microforms in Print,* 1961, Washington, D.C., Microcard Editions, National Cash Register Co., $6. This publication and its companion volume *Subject Guide to Microforms in Print* are issued annually. The current volumes list works from over 80 micropublishers. The *Guide* "is an annual cumulative guide, in alphabetical order, to books, journals, and other materials, which are available on microfilm and other microforms from U.S. publishers."

Many micropublishers have extensive catalogs of their microform products. Examples include *Serials in Microform/1972,* $4.95, from University Microfilms, Ann Arbor, Michigan; a select catalog of newspaper and periodicals on microfilm from Bell & Howell, Wooster, Ohio; and *Princeton Guide to Microforms—Serials* from Princeton Microfilm Corp., Princeton, New Jersey.

Two sources of announcements for ongoing or planned microform projects are:

Microfilm Clearinghouse Bulletin, No. 1, March 19, 1951–, Washington, D.C., Catalog Publication Division, Library of Congress. Issued at irregular intervals as reports are received, the publication appears as a supplement to the *LC Information Bulletin.* Although most recent announcements have been of LC projects, others are listed as they are received.

Microform Review, Vol. 1, No. 1, Jan. 1972–, Weston, Connecticut, Microform Review, Inc. In addition to the "MR News" feature, which announces new micropublishing ventures, two other sections are of particular interest: "Materials in Simultaneous Publication" and "Clearinghouse of Library Microform Projects.' The first lists those titles (usually commercial) micropublishers make available in print and microform at virtually the same time. The second lists micropublishing projects planned or completed by libraries.

Reviews of microform projects are consistently found in *Microform Review.* Some 32 micropublications or microform projects have been critically reviewed in the first three issues. Standardized descriptions and specifications for these projects end each review.

Some recent articles on microforms and their guides are:

Rolland E. Stevens, "Resources in Microform for the Research Library," *Microform Review,* Vol. 1, No. 1, pp. 9-18, January 1972.

Leo Gruliow, "Soviet Serials on Microform," *Microform Review,* Vol. 1, No. 3, pages 203-206, July 1972.

Suzanne Dodson, "The University of British Columbia Library's Guide to Large Collections in Microform: One Attempt to Minimize a Major Problem," *Microform Review,* Vol. 1, No. 2, pp. 113-117, April 1972.

A list of over 100 micropublishers who make their materials commercially available for direct sale (including addresses, phone numbers and brief descriptions of the scope of their works) can be found in:

"Micropublishers," *1972 Microfilm Source Book,* pp. 83-90, Microfilm Publishing, Inc., P.O. Box 2157, Grand Central Station, New York, New York 10017, 1972, $25.

Suggestions for bibliographic control of microforms come from yet three more camps:

W. David Laird, Director of Libraries at the University of Arizona, is one of the 1972-73 recipients of fellowship by the Council on Library Resources. One description of his project states that it will be an " . . . investigation of access to library materials on microform, with a view to developing a plan for a national processing center for microforms."

Felix Reichmann and Josephine M. Tharpe, *Determination of an Effective System of Bibliographic Control of Microform Publications* (Interim Report), Part Two of a report done for the Association of Research Libraries under Contract No. OEC-0-8-080786-4612 (095), pages 45-90, November 1970, Association of Research Libraries, 1527 New Hampshire Avenue N.W., Washington, D.C. 20036 (212) 232-2466. Available from ERIC as document ED 046 404 for 65c in microfiche and $3.29 in hardcopy. Report was to have been released from Greenwood Press in August, 1972.

The idea of a "National (or International) Clearing-House of Microform Titles" is mentioned in: Ladd Z. Sajor, "Preservation Microfilming; Why, What, When, Who, How," *Special Libraries,* Vol. 63, No. 4, pp. 195-201, April 1972.

A final item presents a brief survey of educational material available in microform:

Emma Ruth Christine, "Microfilm in the Curriculum at Henry M. Gunn High School," *Journal of Micrographics,* Vol. 5, No. 3, pp. 141-145, January 1972.

NOTES AND REFERENCES

1. Hubbard W. Ballou. Review of "Demonstration/Sample Microform Kit," (produced by Dataflow Systems, Inc.). *Microform Review,* Vol. 1, No. 3, pp. 245-246, July 1972.

2. Frances G. Spigai, "Computer-Output-Microfilm," *Advanced Technology/Libraries,* Vol. 1, No. 5, pp. 1-8, May 1972.

3. Frances G. Spigai, "High Reduction Microfiche," *Advanced Technology/Libraries,* Vol. 1, No. 2, pp. 1-8, February 1972.

4. Harold Wooster, "Towards a Uniform Federal Report Numbering System and a Cuddly Microfiche Reader–Two Modest Proposals," *NMA Journal,* Vol. 2, No. 2, pp. 63-69, Winter 1968/69.

5. Walter Sullivan, "New Microfilming Method Puts Book on a Sheet of Film," *The New York Times,* November 25, 1972.

6. John A. Van Auken and Richard Van Auken, "Small Office Microfilm (SOM) Products: A Status Report," *Journal of Micrographics,* Vol. 5, No. 1, pp. 5-11, September-October 1971.

7. *Microform Review,* Vol. 1, No. 1, January 1972, Microform Review, Inc., Rogues Ridge, Weston, Connecticut 06880.

8. Edward A. Miller, *Determination of the Administrative and Functional Characteristics of a National Microform Agency, Final Report,* Washington, D.C., Association of Research Libraries, May 1970, 190 pp.

9. Despite the archival qualities of silver microfilm, in 1963 blemishes were discovered on archival type films, most blemishes occurring at the outer end of the roll and at the edges. They were termed redox blemishes because they are produced by an oxidation-reduction mechanism. The cause was traced, not to microfilm aging, but to microfilm storage in cardboard cartons. Peroxides and other gaseous products, discharged during the natural aging of paper cartons, attack the film. McCamy and Pope present a list of 10 " . . . precautions to guard against blemish formation on silver-gelatin type films for the preservation of records of permanent value," in their paper "Redox Blemishes–Their Cause and Prevention," *Journal of Micrographics,* Vol. 3, No. 4, pp. 165-170, Summer 1970.

10. B. J. S. Williams, "Microform Formats and Materials," in *Miniaturized Communications,* pp. 3-23, The Library Association, London, 1970, 190 pp.*

11. Peter Z. Adelstein, "Stability of Processed Diazo and Vesicular Films," *Micro-News Bulletin,* No. 1, p. 9, August 1972.

12. F. W. Dabbs, "Information Through Microcopies; The State of the Art in Diazo Microforms," *Information and Records Management,* pp. 93-98, April 1971.*

13. Williams refers to two papers containing information on scratching and heat damage respectively: "Q's and A's About Diazo," *Systems,* Vol. 7, Pt. 6, pp. 16, 17, 36, June 1966; and "Evaluation of the Atlantic F66 Microfiche Reader," National Reprographic Centre for Documentation TER 67/2, November 1967, 29 pp.

14. "Make Mine Dry; The State of the Art in Thermal Microforms," *Information and Records Management,* pp. 93-98, April 1971.*

15. Allen B. Veaner, "Types of Film Typically Employed in Micropublication; Film Stock; Film Coatings; and Archival Permanence," in *The Evaluation of Micropublications; A Handbook for Librarians,* Library Technology Program of the American Library Association, Chicago, 1971, 59 pp., $3.25.*

16. B. J. S. Williams, op. cit., p. 58.

17. Carl E. Nelson, "Film," in *Microfilm Technology,* McGraw-Hill, New York, 1965, 397 pp., $16.*

18. E. J. Forbes and T. C. Bagg, *A Study of the Requirements and Specifications for Serial and Monograph Microrecording for the National Library of Medicine,* U.S. National Bureau of Standards Report 9446, 1966, 100 pp.

19. B. J. S. Williams, op. cit., p. 62.

---

*These works present lengthy and/or lucid technical and general descriptions of microfilms. Nelson and Veaner give particularly comprehensive coverage to questions about film characteristics (e.g., diazo fading, interfiling of diazo and silver films; effect of fungus; abrasion-resistant and protective coatings and degrading of vesicular images). A brief word of caution is in order–problems and limitations of microfilm discussed in textbooks may be solved by now. A check at National Microfilm Association headquarters (or the local chapter), at the Library Technology Project of the American Library Association, or a phone call to the vendor of the product in question (though reliability of the answer from this source may vary), should bring updated information.

20. Allen B. Veaner, op. cit., p. 40.

21. Rodd Exelbert and Mitchell Badler (in an interview with Alex L. Baptie), "The 8mm Microfilm Concept; The View from Micro-8," *Information & Records Management*, Vol. 5, No. 4, pp. 57-60, April 1971.

22. R. W. Batchelder, "Microfilm Q's and A's," *Information & Records Management*, Vol. 5, No. 7, p. 31, July 1971.

23. L. A. Smitzer, "The Art of Roll Film Look-up," in Vernon D. Tate, editor, *Proceedings of the 17th Annual Meeting & Convention, Chicago, May 21-23, 1968*, 1969, National Microfilm Association, Silver Spring, Maryland, pp. 57-73. Very generously and lucidly illustrated.

24. Charles P. Yerkes, "Micro-forum. Indexing Ultramicrofiche," *Plan and Print*, Vol. 42, No. 9, pp. 14-15, 1969.

25. Hubbard W. Ballou, op. cit.

26. Ian Montagnes, "Scholarly Monographs on Microfiche: The University of Toronto Press as a Case in Point," *Microform Review*, Vol. 1, No. 1, pp. 29-30, January 1972.

27. Brendan F. Somerville, "Abstract Journal Concept Being Examined," *Chemical & Engineering News*, pp. 16-17, June 12, 1972.

28. Theodore F. Welch, "The MLS Book Program; Meeting Microform Halfway/Review Article," *Microform Review*, Vol. 1, No. 1, pp. 48-51, January 1972.

29. Judy H. Fair, "Newsbank Urban Affairs Library" (A Microform Review), *Microform Review*, Vol. 1, No. 1, pp. 48-51, January 1972.

30. Judy H. Fair, "Newspaper Index; The Chicago Tribune, The Los Angeles Times, The New Orleans Times-Picayune, The Washington Post" (A Book Review), *Microform Review*, Vol. 1, No. 1, pp. 65-66, January 1972.

31. Frances G. Spigai, "High Reduction Microfiche," *Advanced Technology/Libraries*, Vol. 1, No. 2, pp. 1-8, February 1972.

32. The April issue of *Microform Review* (Vol. 1, No. 2) contains the following items relevant to ultrafiche collections:

E. M. Grieder, "Ultrafiche Libraries: A Librarian's View," pp. 85-100;

Treadwell Ruml (Encyclopaedia Britannica) and Charles C. Goodman and Henry Grinberg (National Cash Register Company), "Ultrafiche Libraries: The Publishers Respond," pp. 101-108;

E. M. Grieder, "A Rejoinder," pp. 109-111;

W. Carl Jackson, Helen M. Brown and June R. Morroni, "The Library of American Civilization" (A Microform Review), pp. 143-149;

John Webb, "PCMI Library Ultrafiche System" (A Microform Review), pp. 149-155.

33. James B. Adler, "Indexing as the Key to Micropublishing: The Case History of the Congressional Information Service, *Journal of Micrographics*, Vol. 4, No. 4, pp. 239-245, May 1971.

34. Robert F. Fortado, "CIS/Microfiche Library" (A Microform Review), *Microform Review*, Vol. 1, No. 2, pp. 133-136, April 1972.

35. Wilbur C. Myers, "GPO's Potomac Publishing Plans Perturb Publishers," *MICROGRAPHICS News & Views*, Vol. 3, No. 5, p. 1, September 15, 1971. This article recaps the industry's position and refers back to the nine previous articles covering GPO/industry decisions and clashes. Later articles include: Wilbur C. Myers, "Industry Newsfront–Policy Directive on the Joint Congressional Committee on Printing," Vol. 4, No. 10, pp. 2, 3, May 31, 1972; Frances G. Spigai, "IIA Recommendations Would Prevent Competitition Between GPO and Commercial Publishers," Vol. 5, No. 1, pp. 1, 2, July 15, 1972; and Frances G. Spigai, "GPO's Micropublishing Program Near Reality; Meeting on Microfiche Services Contract Draws Heavy Turnout," Vol. 5, No. 4, pp. 1,2, September 15, 1972.

36. The National Technical Information Service, Springfield, Virginia offers a "selective dissemination on microfiche" program for census publications. *Headcount 70*, U.S. Bureau of the Census, State and County Data File. *Complete Count One, 1970 U.S. Census Information* is available at $890 from Infomark Corp., New York, New York. A review of this product appears in the July 1972 *Microform Review*, pp. 139-141. Greenwood Press (Westport, Connecticut) has produced in microform the *nondecennial* census publications listed in the *Catalog of United States Census Publications* prepared by Henry Dubester. Meanwhile international census statistics for 250 countries, colonies and territories are available from Research Publications, Inc. of New Haven, Connecticut.

37. Three systems are reviewed in Joseph M. Dagnese, "Catalog Retrieval Systems on Microfiche; a Preliminary Evaluation," *Special Libraries*, Vol. 61,

No. 7, pp. 357-361, September 1970. Information Dynamics Corp. (Reading, Massachusetts), Library Processing Systems, Inc. (Allentown, Pennsylvania) and National Cash Register Co., Microcard Editions Division (Washington, D.C.) are the systems reviewed. Since then Information Design (Menlo Park, California) has produced CARDSET, a COM-produced index to MARC data; catalog card data are also on microfilm to be hardcopy produced in sets on demand for CARDSET customers. Book jobbers (Richard Abel, Portland, Oregon; Bro-Dart, Williamsport, Pennsylvania) and yet another micropublisher (Paris Publication, Port Washington, New York) are also vying for the catalog data market, according to a lead article on micrographics at 1972 SLA and ALA annual conferences, in *MICROGRAPHICS News & Views,* Vol. 5, No. 3, pages 1-3, August 31, 1970. Another new entry into this field is The British National Bibliography's *Books in English:* Catalog records from the MARC files of BNB and the Library of Congress on ultrahigh reduction microfiche (150X). A recent description of this project can be found in: J. E. Linford, "Books in English," *Microform Review,* Vol. 1, No. 3, pages 207-213, July 1972.

38. Two articles, somewhat out of date, but nevertheless useful, compare commercial systems and discuss advantages and disadvantages. They are: D. Kennington, "Product Information Services–Some Comparisons," Aslib *Processing,* Vol. 21, No. 8, pp. 312-316, 1969; and Ralph E. Swinburne, Jr., "Microfilmed Catalog Services," *Journal of Chemical Documentation,* Vol. 10, No. 1, pp. 17-20, February 1970.

39. A rare review of micropublishing standards and how they conform to library needs is in: Allen B. Veaner, "Microrepublication and Micropublication Technical Standards–What They Mean to You the User," *Choice,* Vol. 5, No. 7, pp. 739-744, September 1968.

MICROFORM EQUIPMENT: A GUIDE TO THE LITERATURE

Three types of equipment will be discussed: (1) Containers and storage equipment; (2) readers and reader-printers; and (3) retrieval equipment. There are many other types of equipment making up the full range of products available in the micrographics marketplace, but most have to do with film developing and production, and are outside the scope of this paper.

The reader is referred to the following reference for all categories of equipment:

Hubbard W. Ballou, *Guide to Microreproduction Equipment,* Fifth Edition, National Microfilm Association, Silver Spring, Maryland, 1971, 793 pp., $21, $17.50 to NMA members. Each piece of equipment is shown in a photograph and described in a detailed, standardized format. Because of publication deadlines, the newest models are often missing. Cameras, readers, reader-printers, processors, duplicators, enlargers, retrieval equipment, and accessories (editors, splicers, mounters, densitometers, and storage equipment) are included.

For full coverage of computer-output-microfilm products, the reader is advised to consult:

Don M. Avedon, *Computer Output Microfilm,* Second Edition, National Microfilm Association, Silver Spring, Maryland, 1971, 279 pp., $10, $7.50 to NMA members.

Containers and Storage Equipment

• Containers. The distinction made in this paper between containers and storage equipment is that containers are designed to house individual roll films, whereas a piece of storage equipment is meant to accommodate multiple roll film or microfiche units.

Containers for roll film are very nicely described and illustrated in R. W. Batchelder, "Microfilm Q's and A's," *Information & Records Management,* Vol. 5, No. 10, p. 33, October 1971, and the illustrations are included here as Figure 4. The three items on the left side of the chart—core, spool, magazine—are all basically for use with unexposed and/or undeveloped film. The three center items—reel, cartridge (single core), cassette (two cores)—are all fundamentally intended for use with developed microfilm in reading apparatus. . . . On the right we have three basic items involved with storage.

Reels are designed for use in manually operated microfilm readers. Cartridges and cassettes are designed for use in motorized readers and reader-printers.

Advantages of cartridges and cassettes over reels are:

Eliminates much of the film-handling by patrons—keeps the films cleaner.

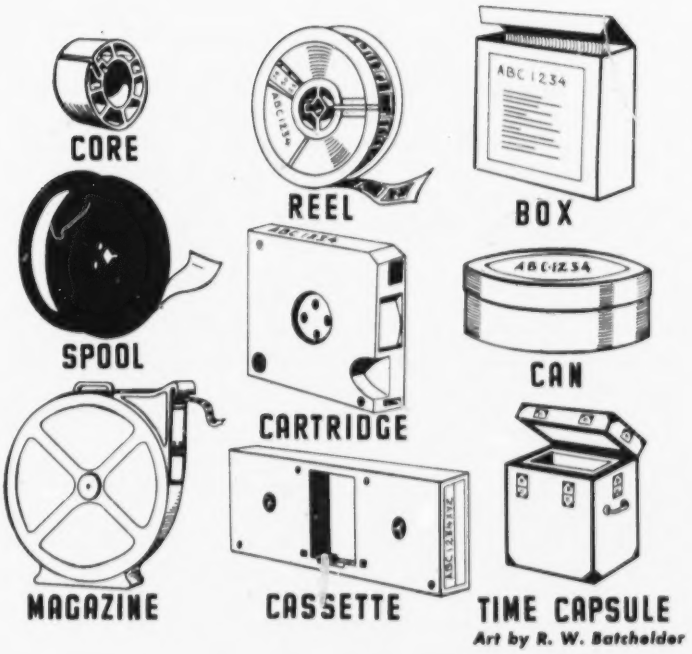


Figure 4. *Microfilm Containers* (Reproduced from R. W. Batchelder, "Microfilm Q's and A's," *Information & Records Management,* Vol. 5, No. 10, p. 33, October 1971 by permission from the publisher.)

Eliminates misfiling, since cartridges or cassettes can be labelled and are not boxed.

Can be used with motorized film readers, therefore speeding up the image-locating process.

Disadvantages, in comparison to reels, are:

Costs

Equipment costs (e.g., $.65-$2.85/cartridge or cassette).

Loading costs (e.g., service charges of 60c and up, or staff time to convert from reel).

Cartridge film (from 10-50% higher than open reel film).

Increased wear and tear on film and reader.

Incompatibility between most systems.

Advantages of cassettes over cartridges or reels:

Eliminates threading.

Requires a less complex (therefore cheaper) reader design.

Film can be removed from the reader at any time without rewinding. (However, cassettes usually require more storage space.)

These points, as well as compatibility problems, alternative systems, film transport design and well-illustrated descriptions of five popular 16mm and 35mm cartridge and cassette systems, are lucidly presented specifically for the librarian's consumption in:

Francis F. Spreitzer, *Microfilm Cartridges and Cassettes,* Library Technology Project, American Library Association, Chicago, May 1972, 13 pp.

Specifications, descriptions and good illustrations (complete with dimensions) are presented for twelve cassette and cartridge systems in:

Microfilm Container (Cartridge and Cassette) Survey, Dataflow Systems, Inc., Bethesda, Maryland, Revised, November 12, 1971, 19 pp. (Available as TM501-1971 from the National Microfilm Association, $2.25, $1.50 for NMA Members).

One library's experience in converting from roll to cartridge is described in John J. Oliva, "Microfilm Cartridge System at Prince George's Community College," *Journal of Micrographics,* Vol. 6, No. 2, pp. 89-92, November-December 1972.

• Storage Equipment. Cabinet-type units "suitable for the archival storage of 35mm and 16mm roll microfilm or 3x5 or 4x6 inch microfiche" are listed for models of 23 manufacturers, along with their prices, dimensions, number of drawers or shelves, and filing capacities, in: *Microform Storage Cabinets: A Survey,* Library Technology Project, American Library Association, Chicago, March 1972, 26 pp.

A less restrictive survey of microfiche and microfilm holders and filing cabinets pictures and briefly describes some 30 products in: "Directory of Microfilm Housing Equipment," *Information & Records Management,* Vol. 6, No. 5, pp. 32-36, May 1972. Notebook-type microfiche holders, bins, and carousels are featured as well as cabinets.

Readers and Reader-Printers (R/P's)

The set of *Microform and Equipment Reports* in the Library Technology Reports is the first place a librarian should look for evaluative information on readers and reader-printers. Among the reports published by LTP are the following:

Microform Readers for Libraries, May 1971, 23 pp. (this includes selection policies).

The Selection of a Micro-Opaque Reader, September 1966, is probably less out-of-date than the September 1966 report, *The Selection of a Microfiche Reader.*

A Survey of Microform Readers, January 1972, includes the following information for about 80 models: Manufacturer or distributor; formats accommodated (maximum size); screen size; weight; magnification; rotation; price; comments (e.g., options and special features).

Most important, LTP is the only agency, outside of Britain's NRCd, that provides detailed evaluation and specifications of readers and reader-printers specifically with the librarian in mind. Evaluations range from 3-30 pages in length. About 45 models have been evaluated so far. A new batch was due for September 1972 publication.

A typical report might include the following information: manufacturer's name and address; distributors and location; price and lease costs; film formats accommodated; dimensions; weight; screen projection (rear, front); screen description; reader construction; projection lens; power requirements; electrical components; focusing methods; film transport mechanism; image rotation; projected micro-image area; quality of image; operator-machine relationships; hazards; accessories; warranty; maintenance; group evaluation; general comments and analysis.

LTP distributed a simple 10-point checklist for selecting a microform reader a couple of years ago. It's worth reproducing:

1. What microforms does the reader accommodate? Microfilm? Microfiche? Micro-opaques?
2. What size microforms will the reader accommodate?
3. Is the lens magnification compatible with the reduction ratio of the microforms held in the library's collection?
4. Is the screen large enough to present the full width of text? If not, is there a scanning mechanism?
5. Is the screen translucent or opaque?
6. Is the screen image sharp and clear from edge to edge?
7. Is the screen well and evenly illuminated? Is there sufficient contrast between the black and white areas of the film?
8. Does the screen image remain in focus when the microform is moved from frame to frame?
9. Is image rotation provided?
10. Is the reader easy to assemble and use? Are the attachments, e.g., additional lenses, microfiche or roll attachments, easy to install?

A seven-step selection procedure, accompanied by worksheets for requirements, specifications, and evaluations, is provided in:

Alonzo J. Sherman, "How to Select a Microfilm Reader or Reader-Printer," *Information & Records Management,* Vol. 6, No. 4, pp. 62-66, April 1972.

As Sherman points out, there are over 100 basic models and 2000 model variations from which to choose. About 60% have microfiche capability; 45% roll capability, 35% aperture card capability and 30% cartridge or cassette capability. About 60% accept only one format; 20% two, 15% three and 5% all four. Too, the task of choosing among models is complicated by distributors (versus manufacturers) giving another name to a reader or R/P already on the market. For example, the K-100 Escort microfiche reader produced by Micro-Scan is marketed by the 3M Company as The Consultant. Image Systems' CARD system—an automated fiche retrieval system—is also produced and sold by Remington Rand under the name RemKard. A taste of this variety is evident in the handy way readers and R/P's are categorized in the 1972 *Microfilm Source Book*, page 31-38. Readers are categorized first by the format they can accommodate, and within the format, by their size or portability. Categories, together with the number of models available in that category and the low price, average price range and high price, are presented below:

Equipment	Format	Size	Number of Models	Prices in $ Low	Avg. Range	High
Readers	Rollfilm, 16mm	Portable	3	300		400
Readers	Rollfilm, 16mm	Tabletop	16		135-500	2600
Readers	Rollfilm, 16mm	Console	13		400-700	950
Readers	Rollfilm, 35mm	Tabletop	7		135-600	2640
Readers	Rollfilm, 35mm	Console	6		500-750	950
Readers	Cartridge, 16mm	Portable	4		450-600	
Readers	" 16+/or 35mm	Tabletop	4		200-475	1700
Readers	Cartridge, 16mm	Console	19		400-1300	2000
Readers	Cartridge, 35mm	Console	2	500		900
Readers	Microfiche	Handheld	3	3-22	35	125
Readers	Microfiche	Portable	13		60-150	250
Readers	Microfiche	Portable Lap	5	30	140-160	
Readers	Microfiche	Tabletop	58	50	95-275	1000
Readers	Microfiche	Consoles	13		200-425	1300
Readers	Combination Format	Portable	2	500		600
Readers	Combination Format	Tabletop	8		170-650	1700
Readers	Combination Format	Console	20		400-750	1700
Ultrafiche readers			3	150		650
Double page			7		375-400	1300
Reader-printers		16mm roll	15		1100-3000	4000
Reader-printers		35mm	13		1300-3500	6000
Reader-printers		Cartridge	8		1500-3800	
Reader-printers		Microfiche	20	350	1100-2300	3500
Reader-printers		Ultrafiche	2	1500		3000
Reader-printers		Multiform (Combination)	17		1100-3500	5000

Some 169 readers and R/P's for 43 manufacturers are listed along with the micro formats they accept; screen dimensions and color; image rotation capabilities; magnification(s); size and weight; collapsibility; maximum print size; print speed; print process; price; and other features and accessories in:

"Microfilm Readers and Reader-Printers," *Business Automation*, Vol. 18, No. 14, pp. 82-93, Dec. 1971.

It's worth noting that the NMA has issued an extract from the 1971 *Guide to Microreproduction Equipment: Readers/Reader-Printers Guide*, is available at $7.50 from NMA.

Other annual round-ups feature new equipment shown at NMA. Many of these are readers, reader-printers. Two sources for last year's information are:

"NMA Review 1972," *Information & Records Management*, Pt. 1, Vol. 6, No. 6, pp. 26-37, June 1972, Pt. 2, Vol. 6, No. 7, pp. 34-38, July/August 1972.

"Industry Newsfront," *Micrographics News & Views*, Vol. 4, No. 10, pp. 3, 4, May 31, 1972, Vol. 4, No. 11, pp. 4, 5, June 15, 1972.

There are three additional reports surveying the reader, reader-printer field which have been released since 1970 and which also deserve mention:

Microform Retrieval Equipment Guide, National Archives and Records Service (GSA), Washington, D.C. Office of Records Management, 1970, 69 pp. Produced under a contract jointly funded and administered by the Air Force and GSA; available from ERIC as ED 051 865; microfiche 65c, hardcopy $3.29. Introductory chapters: Microforms, Formats and General Considerations; General Factors in Equipment Selection; and introductory sections to each of the equipment chapters: Conventional Roll Microfilm Readers and Reader Printers; Motorized Roll Film Readers and Reader Printers; Microfiche and Microfilm Jacket Readers and Reader Printers; Aperture card readers and reader printers; Other Microfilm Display and Reference Equipment give lots of basic information. The rest serves as a directory portion to the equipment.

This report has also been issued as:

Mark McKay, editor, *A Guide to Microforms and Microform Retrieval Equipment*, Applied Library Resources, Inc., Washington, D.C. 1972, 64 pp. Available from ERIC as ED 059 750; microfiche 65c, hardcopy $3.29. Despite its 1972 date it's identical to the NARS report above, though it makes no reference to it.

Ronald F. Gordon, *16mm Viewing Equipment Guide*, Defense Documentation Center, Alexandria, Virginia, January 1971, 92 pp. Available from NTIS, Springfield, Virginia as AD 718 000, microfiche 95c, hardcopy, $3. Manufacturer-provided photographs and detailed specifications and features are uniformly listed for each of the 45 readers and/or reader-printers included. Seventeen evaluation criteria are listed for reading equipment, with eight additional characteristics to look for in a reader-printer.

Ronald F. Gordon, *Microfiche Viewing Equipment*, Defense Documentation Center, Alexandria, Virginia, March 1970, 97 pp. Available from NTIS as AD 701 600; microfiche, 95c, hardcopy, $3. Photographs and detailed

listings of features and specifications are presented for readers and/or reader-printers. Prices and descriptions are as of January 1970.

Retrieval Equipment

For some reason, motorized readers and reader-printers which accept microfilm cartridges and cassettes and locate frames automatically are consistently categorized as motorized microfilm readers and reader-printers. On the other hand, motorized readers and reader-printers which accept microfiche cartridges and cassettes are categorized as microform retrieval devices. Following this illogic, a selection of microform retrieval devices and their literature will be presented.

Microfiche retrieval systems are discussed in three documents. A 1970 study and survey describes the needs of 50 active military users. Design objectives and specifications are documented for (1) a system useful for users with active collections of less than 10,000 documents, and (2) a fully automated modular system which provides on-line operation of a variety of output devices for users with active collections up to 30,000 documents in size. Details can be found in:

Roger Wicker et al., *Microfiche Storage and Retrieval System Study: Final Report,* System Development Corporation, Falls Church, Virginia, August 10, 1970, 51 pp. Available from NTIS, Springfield, Virginia, as AD 710 000.

A condensation and overview of the study is presented in:

Alan W. Wilber, "Microfiche Systems for the Small User," *Journal of Micrographics,* Vol. 5, No. 3, pp. 131-136, January 1972.

Turning to the problems of the large (over 50,000 microfiche) user, an extremely useful paper explores the capability of three commercial automatic microfiche retrieval systems to accept unaltered COSATI microfiche (18-20X at the time of this paper):

George W. Tressel et al., "Automated Retrieval and Remote Viewing of COSATI Microfiche–Problems and Prospects," in Jeanne B. North, editor, *Proceedings of the American Society for Information Science, 33rd Annual Meeting,* Vol. 7, 1970, Washington, D.C., American Society for Information Science, pp. 123-128. Conclusions are that "there is no operationally proven, large-scale system for automatic retrieval and remote viewing of unmodified COSATI microfiche. . . . Image quality is only marginally acceptable for remote viewing. Maintenance of the equipment is, for all practical purposes, a full-time job," and ". . . these microfiche retrieval systems cannot be justified solely on the speed of retrieval . . .a well-trained filing clerk could retrieve microfiche as quickly as an automated file." Harsh words, but certainly worthy of consideration when evaluating retrieval systems today.

Microform retrieval devices can be characterized by several features:

On-line data base. This means the total number of pages which can be searched from one viewing unit at one time. Often systems allow you to start out with one capacity (e.g., 100,000 pages) and build up to another capacity (e.g., 1,000,000 pages). Systems that search cassettes and cartridges can have a large off-line data base, but the on-line data base is limited to the capacity of the cartridge or cassette. For example, the Miracode system by Eastman Kodak, listed in Table 2, can search one cartridge of coded roll microfilm at a time. Its on-line capacity is thus less than 2,000 images or the capacity of one cartridge. However, there can be a large collection of cartridges, making the off-line data base size unlimited.

Access time. In microform retrieval systems this is usually considered the time needed to locate and display the desired image after the image identification number has been determined through on-line or off-line indexes.

Remote viewing of images by closed-circuit TV, and on-line, "computer-controlled" indexes are two common options in the more expensive retrieval models.

Table 2 incorporates these features. It was prepared for system comparison purposes only and reflects only about a third of the retrieval units on the market today. Information within the table was compiled from trade magazines, directories and manufacturers' literature dated 1971 and 1972. Its accuracy is questionable, because prices, capabilities and options change with time, and many modular systems have extremely wide price ranges. For current information on a system you may be interested in, one with the configuration fitting your exact needs, always contact the manufacturer directly. Most of these systems are briefly described in: "A Directory of Microfilm Information Storage and Retrieval Systems," *Information & Records Management,* Vol. 6, No. 1, pp. 33-36, January 1972.

A new philosophy of microform retrieval comes with ultramicrofiche (UMF) which contain images reduced 150X or more. The 4"x6" microfiche that holds 60 images at 20X holds well over 3000 images at 150X (the equivalent of the retrieval capacity of Micrographic Technology Corporation's Model 95, or of a densely packed microfilm cartridge or cassette at more conventional reduction ratios). The race to build competitive UMF retrieval systems has been on for the past year, with perhaps half a dozen new systems ready for custom applications.

While older systems (e.g., Mosler's, IBM's Walnut,

TABLE II. Characteristics of sample microform retrieval systems

Manufacturer (Model)	Maximum access from one display unit in pages (number pages from one module)	Access Time	Remote Viewing	On-line index	Microform format accepted	Output	Cost
Access Corp. (System M)	320,000 (120,000-160,000)	3 secs.	Yes	No	Microfiche or aperture card	Display	$10,000 and up
AIL Information Systems (Filesearch IV)	32,000	5 secs. (max)	No	Yes	1000 ft. reel	Display, hardcopy or 16mm or 35mm film copies	$200,000
Automatic Information Retrieval, Inc. (Taurus DCS-1000)	36,000,000 (1000 microforms; up to 600,000 pages)	10 secs. (max)	Yes, up to 65 remote viewers	Yes	mixed microform	Display or hardcopy	$100,000 up to $1,900,000
Eastman Kodak (Miracode II)	100 ft. of 16mm cartridge microfilm less than 2000 images)	at 350 images/sec., about 6 secs. max	No	Yes (logic box)	16mm roll microfilm in cartridges	Display (also remote hardcopy; microfacsimile from Alden)	$15-30,000
Image Systems, Inc. (CARD)	68,000-130,000 (features interchangeable cartridges of 500 images)	4 secs. (max)	No	Yes	20X and 42X fiche in cartridges	Display hardcopy	$5,000 and up
Microform Data Systems Mindex 380	120,000	3 secs. (avg.)	No	Yes	ultrafiche at 210X in cartridges	Display	Varies with size of system
Micrographic Technology Corp. (Model 95)	30 fiche/cartridge 1800-9750 pages/cartridge	3 secs.	No	No	20X, 24X or 42X microfiche in cartridges	Display	$1990-$2490
Morgan Information Systems (Morgan 200)	100,000 at 42X	2.5 secs.	–	Yes	105mm rolls and 16mm rolls	Display	$11,000
Mosler (410)	1,000,000 (100,000)	6.5 secs.	Yes	Yes	Aperture card 35mm chip 250X images or microfiche		$30,000 and up
Ovonic Image Systems, Inc. (Model 401)	100 fiche/magazine 6000-30,000 pages/magazine	"seconds"	No	No	20X, 24X, 42X & 48X microfiche	Display	$1000-$1300
3-M (Microdisc)	One cartridge 2000-3000 pages at 24X	45 secs.	No	Yes, over 400,000 document indexes searched	16mm rollfilm cartridges	Display hardcopy	$35,000-$50,000
Varian-Adco (Model 626)	18,000,000 (300,000)	10 secs.	Yes, up to 60 remote viewers	Yes	Aperture cards and fiche cameras; high reduction	Display hardcopy	$100,000 and up

and Microform Data's Mindex) are designed for the very large data bases (millions of images) and are automatic, at least two new ones depend on sophisticated reader design (complete with built-in index capability) and microfiche layout to achieve fast retrieval of many thousand documents (e.g., 30-50,000) by manual means. UMF Systems and the National Cash Register Company displayed such systems at last year's NMA Convention. Price tags are in the $1000-$3000 range. Applications have been for "directory" systems (telephone look-up, credit checks, airline reservations). However, the introduction of UMF publications to library collections may create another market for these new retrieval devices.

Small Office Microfilm (SOM) Equipment

There are a number of micrographic firms going after the small-volume user market. An excellent discussion and outline of small office microfilm (SOM) products can be found in:

John A. Van Auken and Richard Van Auken, "Small Office Microfilm (SOM) Products: A Status Report," *Journal of Micrographics*, Vol. 5, No. 1, pp. 5-11, September-October 1971.

Many of the products described are said to be under development by Saxon Development Corp. (Miami Beach, Florida). Five key features of SOM equipment also serve as a definition of SOM: "SOM supports the purpose of individuals; SOM products fit decentralized economic constraints (e.g., approximately $1000 for a total system); SOM builds private personal data bases; SOM strengthens the interoffice information transfer; SOM ties small offices to central information installations."

Libraries and information centers should be aware of this growing new industry within an industry for two reasons: To determine if there are valid uses within the library which can be integrated with current and future microform systems, and to understand yet another storage and retrieval system geared to individuals who probably also make heavy use of the library.

A few new firms offer complete, low-cost systems which make use of 8mm film (at 38-46X). Microfiching is made simple with push-button camera equipment which can be purchased, or rented by the hour; processing and duplicating services are available from the camera manufacturer or distributor. Costs average 3¢ per image where users typically receive a cartridge containing 50 feet of super 8mm film—enough for 1600 images, which become 10 microfiche , each with 160 images in a 16 by 10 matrix. Millifile (3 Westchester Plaza, Elmsford, New York 10523 (914) 592-5524) markets such a camera and microfiche reader for under $1400.

This same system is featured as PERSONAFILE by Microdoc (815 Carpenter Lane, Philadelphia, Pennsylvania 19119 (215) 848-4545). Microdoc has put together a few more system pieces: Camera rental by the hour, provision of a security set of fiche and binder files for a reference set of fiche, and . . . "a modified 'uniterm' indexing concept and a manually updateable thesaurus display for controlling the index vocabulary."

The Micro-8 Company (see fn. 21) was first to the market with a full line of cameras and reading equipment built around the 8mm format. Micro-8 features cassettes (versus microfiche) which contain up to 2000, 8½"x11" pages, and lightweight "portable, automatic, cassette-loading, motor-driven, 8mm microfilm viewers" which cost $260 and up. A lap reader and a reader-printer are also available for these 8mm cassettes.

At least two companies supply low-cost microfiche retrieval units for a range of reduction ratios (20-48X). Early last year Micrographic Technology Corp. (1815 S. Ritchey St., Santa Ana, California 92705 (714) 836-6621) demonstrated a self contained camera/processor (Model 750) which makes finished fiche at 20, 24, 27, 30 or 42X. An average of 600-900 documents per hour can be filmed onto the microfiche, though the unit is capable of accepting and recording a new document every three seconds. The Model 750 sells for about $10,000, but includes the processing step. MTC also produces a microfiche retrieval unit: the Model 95. The Model 95 accepts cartridges which house 30 microfiche (about 3000 images at 24X; up to 9750 images at 42X). It can retrieve a fiche and display an image within three seconds. Its price is $1950.

A company that promises to give MTC's Model 95 stiff competition is Ovonic Image Systems, Inc. (7522 Clairemont Mesa Blvd., San Diego, California 92111 (714) 279-7971). Ovonic unveiled a reader at last year's National Microfilm Association Convention which will sell from $1000 to $1300 "depending on quantities, magnification ratios, and options." It features "a one hundred microfiche capacity interchangeable magazine with an integral index that is automatically displayed on the screen prior to, and between, fiche selections." At 24X, the capacity of one of Ovonic's magazines is about 10,000 images.

The "Cuddlies"

A trend which feeds the SOM philosophy and which can be spotted within every technology striving to appeal to a mass market is portability. Miniaturization is the most obvious side effect. It is a fact that smaller and more portable readers are more prevalent today than five years ago. Since the mid 60's, when the Office of Education let a contract to DASA Corporation, Andover, Massachusetts, to build "the $50 reader," the race to design THE small, inexpensive reader has intensified. (Individual portable readers produced by DASA sell for $89.)

Since DASA, at least half a dozen new portable readers have been designed and sold for under $100—some less acceptable than others. A recent article on

portability, including a guide to 18 portable microfilm readers, appeared in:

Rodd S. Exelbert, "Portability: Catalyst for Microfilm Growth," *Information & Records Management,* Vol. 6, No. 10, pp. 32+, November, 1972.

A totally new concept in reader optics uses 3,500 tiny lenses the size of ball-point pen tips instead of a single lens. Mass production of these readers may result in a new price range: The inventors say as little as $5 apiece, though there is much skepticism about this figure. These readers, designed by Personal Communications, Inc., of Stamford, Connecticut, would need to be just slightly larger than the original page and only one-half inch thick.

Since formatting of the text on the film is completely different from the text formats in current use, the most likely initial applications will be with computer-output-microfilm. Retrospective filming of books and other documents wouldn't provide film which could make use of the unique reading methods employed by these new readers.

However, future texts of up to 625 pages can be filmed at 24X onto a sheet of microfiche the size of the original filmed page (e.g. 8½"x11"). Although the master microfiche is expected to be very expensive, the inventors forecast a price of 25c for duplicate microfiche copies.

Don't reach for your credit card just yet though. There are only one or two prototypes of the reader in existence. Perhaps production models will be available in a year or two. . . . Then we can talk about price.

A discussion of microfilm equipment wouldn't be complete without mentioning that there are several firms supplying reconditioned, and sometimes new, used equipment. Two such firms are: Alan Gordon Enterprises, Inc., 5362 Cahuenga Boulevard, N. Hollywood, California 91601 (213) 985-5500 and MS, "the new-used company," Division of Microsystems, Inc., 1717 Barnum Avenue, Bridgeport, Connecticut 06610 (203) 366-7549.

Recent promotional brochures show savings of well over 50%.

USER STUDIES–A SELECTED SURVEY

Harold Wooster, *Microfiche 1969–A User Survey,* July 1969, 205 pp (AD 695 049). Available from NTIS, Springfield, Virginia 22151. Over 300 letters to the author, speaking out on the pros and cons of fiche, are excerpted and categorized to fit into the following chapter headings: Department of Defense Libraries; Impact of DDC User Charges; Government Libraries; Industrial Libraries; University and Non-Profit Libraries; Individuals and Microfiche (The Enthusiasts, The Reluctant Converts, The Agonistics); Fiche Quality and Format; Microfiche Readers and Reader-Printers. A delight to read.

Lee N. Starker, "User Experiences with Primary Journals on 16-mm Microfilm," *Journal of Chemical Documentation,* Vol. 10, No. 1, pp. 5-6, February 1970. "Once users became accustomed to the ease of handling cartridge-packed film, to the speed of searching via motorized transports, and to the convenience of rapid, on-the-spot copies, we found that our former recalcitrants were actually requesting that more journals on microfilm be obtained." Original plans to have two microfilm users' areas–one for abstract journals, one for primary journals–are being reconsidered after initial "praise for the ability to search *Chemical Abstracts* and then to be able immediately to check the journal articles without moving from the microfilm reader."

Stuart M. Kaback, "User Benefits from Secondary Journals on Microfilm," *Journal of Chemical Documentation,* Vol. 10, No. 1, pp. 7-9, February 1970. ". . . print capability is an essential feature for the effective use of microfilm versions of secondary journals, primary journals, patents, or any other documents." Two specific advantages of having secondary journals on microfilm (using a cartridge-loading reader-printer) are: Ease and speed of look-up (the author averaged about 30 seconds an abstract for a group of 400 references) and the ease and legality of copying from microfilmed journals. Note-taking and photocopying from large, bound volumes is obviated. In the cases where the microfilm lease includes the right to make copies, copyright is not being violated.

Louise Giles, *A Research Project to Determine the Student Acceptability and Learning Effectiveness of Microform Collections in Community Colleges. Phase I. Final Report,* American Association of Junior Colleges, Washington, D.C., June 1970, 248 pp. Available from ERIC as ED 040 708 for 65c in microfiche and $9.87 in hardcopy. This phase laid the groundwork for the next one and the report contains no experimental information on microform acceptance. During this phase a survey of community colleges was made in order to determine which courses to include; subject specialists were selected to compile bibliographies of references for each course included; the bibliographies were received and processed; and plans were laid for the continuation of the project.

Dale Gaddy, *A Partial Report of A Research Project to Determine the Student Acceptability and Learning Effectiveness of Microform Collections in Community Colleges.* Phase II, June 1971, 82 pps, American Association of Junior Colleges, One Dupont Circle, Washington, D.C. 20036. Phase II "consisted of developing procedures and instruments, evaluating microform equipment, preparing and packaging microform materials, and testing the effects of selected variables that are potentially critical to student acceptance and learning." Five pilot studies were conducted to identify variables: mode-roll, fiche, correspondence between reference work and unit size of microform; library access or

home access to equipment; content; subject matter; image polarity: positive or negative film; frame presentation–vertical or horizontal. "Experimental students evidenced little resistance to microforms . . . " and "microform acceptance is not differentially affected by the above five factors." Phase III's main objectives (restructured) will be to develop and assess a set of guidelines that will aid librarians of two-year colleges to select, organize and utilize microform systems. Guidelines will include: "an inventory of available microform hardware and software; a description of optimum microform systems for reference, archival, and instructional purposes; and a checklist for acquiring, organizing, updating, and administering microform systems." So much for a user survey! Dr. Gaddy plans for completion of the "guidelines" report in 1973.

Ralph W. Lewis, "User's Reaction to Microfiche: A Preliminary Study," *College & Research Libraries*, Vol. 31, No. 4, pp. 260-268, July 1960. Recent emphasis placed on the use of microfiche by large government agencies has increased the pressure on libraries supporting government research to make greater use of microfiche. Negative and apathetic user attitudes, expressed by researchers, indicate that expanded use of microfiche will have to be accompanied by concentrated efforts to overcome resistance if the great potential of microfiche is to be realized. Perhaps the most basic problem is the reluctance of users to accept microcopies, caused mostly by inconvenience and deficiencies in the quality of available reading equipment. Efforts in microphotography, expended on technical achievement in the past, should be directed toward understanding the user and his needs to discover why he avoids microforms and how to overcome his resistance to them. (*Information Science Abstract* No. 71-2614; augmented from the original publication.)

A continuation of Mr. Lewis' interest can be found in:

Giuliana A. Lavendel, *A Minisurvey with Larger Implications: User Resistance to Microfiche at NASA's Ames Research Center,* A research paper presented to the faculty of the Department of Librarianship, California State University, San Jose, Master's Thesis, August 1972, 58 pp. A sample of 20 researchers, known to be antagonistic toward microfiche, were interviewed (in their own working environment) in detail regarding their work habits and views on the use of research reports on microfiche. An additional 20 researchers were briefly interviewed to confirm initial conclusions. Main conclusions drawn are: working copy for research work must be hard copy. "On the other hand, the microfiche of our study . . . can be extremely valuable 1) as a storage medium; 2) in the process of scanning and screening large files in search of relevant materials." A microfiche program would be most successful with 1) many readers conveniently scattered around work stations, 2) a central service for providing hardcopy from the microfiche (vs. the user obtaining it from a reader-printer). "The most popular reason for giving preference to microfiche appears to be its easy and speedy availability (for technical reports)."

Donald C. Holmes, *Determination of User Needs and Future Requirements for a Systems Approach to Microform Technology,* Association of Research Libraries, Washington, D.C., July 19, 1969, 35 pp. Available from ERIC as ED 029 168 for 65c in microfiche and $3.29 in hardcopy. Seven problems were identified:

1) The variety of types of microform, each of which demands specialized equipment for its storage and use.
2) The lack of an optimum physical environment for microform use, including proper lighting, temperature and humidity controls, and equipment, including reading machines and furniture.
3) The amount of handling involved in the acquisition, cataloging and use of microforms, which results in loss and damage and serious inconvenience to the user.
4) The lack of an adequate system of bibliographic control of microforms, which diminishes access to them and presents difficulties in their acquisition and cataloging.
5) The lack of sufficient data on the most effective means of administering microform collections.
6) The absence of an effective method of ensuring that all producers of microforms will observe appropriate production standards.
7) The lack of an authoritative structure or procedure which could effect a more rational decision-making process in determining which type of document should be reproduced in an appropriate type of microform.

It was the respondents' belief that microforms will only "come of age" when these and other obstacles to their use are overcome.

Donald C. Holmes, *Determination of the Environmental Conditions Required in a Library for the Effective Utilization of Microforms,* Association of Research *Libraries,* Washington, D.C. November 1970, 44 pp. Available from ERIC as document ED 046 403 for 65c in microfiche, $3.29 in hardcopy. This follow-on study to the one above provides findings and optional design suggestions in five areas: 1) microform reading areas (e.g., a minimum 40 sq. ft./reading station; low intensity light; temperature and humidity control; acoustically treated; adjoining work station for microform inspection, cleaning and repair); 2) microform study carrel (individual lighting; ability to change the viewing angle; space for note-taking and consultation of other materials); 3) supporting functions (increased priority for cataloging and inspecting microforms within libraries); 4) storage and

handling (temperature and humidity control, proper cabinet materials); 5) education (the librarian should be well versed in the ability to use microform equipment, so that proper instructions can be given to users; written instructions should also be available).

J. F. Reintjes, et al., *Microfilm Viewer Experiments. Final Report,* Massachusetts Institute of Technology, May 31, 1971, 70 pp. Available from ERIC as ED 051 671 for 65c in microfiche and $3.29 in hardcopy. Some of the complaints users have had in the past about microform readers led Project Intrex to design two readers incorporating positive features. "The 'desktop viewer' was designed to achieve maximum image quality and accommodation to personal comfort (e.g., viewing surface can be tilted) while the person is seated at a desk." The other reader employs a high magnification system which displays images four times actual size and is used at a viewing distance of five feet; push-button controls are embedded in the user's chair. Evaluations were generally favorable.

J. J. Gardner and C. L. Keator, "User Preference Study," in *Project Intrex Semi-Annual Activity Report, September 15, 1971-March 15, 1972,* Massachusetts Institute of Technology, Cambridge, Massachusetts, March 15, 1972, pp. 95-99.

J. J. Gardner and M. P. Canfield, "User Preference Study," in *Project Intrex Semi-Annual Activity Report March 15, 1972-September 15, 1972,* Massachusetts Institute of Technology, Cambridge, Massachusetts, September 15, 1972, pp. 54-57. Statistics for this six-month period, when compared with those given since September 1970, show how a well-controlled experiment can produce meaningful results. Early statistics showed that those who chose microfiche over hardcopy did so primarily because of its low cost (for a time it was free at the MIT Library vs. costs of 5c and 10c per page for hardcopy), its convenient size (for storage and portability), and because of curiosity about this new publishing medium.

Those early users who chose hardcopy did so because there was no reader outside the library or because of the need for frequent referral to the document requested. With the availability of free hardcopy or fiche copies, loans of portable microfiche readers, and two years of microfiche promotion, a whopping 80 percent of the user preference study participants selected microfiche. Convenience displaced low cost and curiosity as reasons for choosing fiche, and the "unavailability of microfiche readers outside the library" as a reason to choose hardcopy predictably decreased (80 percent in 9/70; 67 percent in 9/71; 33 percent in 3/72; and 26 percent in 9/72).

Dolly D. Svobodny, *A Program to Demonstrate the Uses of an Inexpensive Microfiche Reader, and the Resources of ERIC and Other Microform Information Collections. Final Report,* Modern Language Association of America, New York, March 25, 1971, 49 pp. Available from ERIC as ED 048 744 for 65c in microfiche and $3.29 in hardcopy. The DASA portable microfiche reader and microfiche were demonstrated to members of the Modern Language Association to obtain their reactions. There was general acceptance of the reader, with a few specific criticisms. Users would prefer to pay $50-60 for a reader, unless it could accommodate film and fiche, and a range of magnifications (e.g., 20X to 42X)–for this, they'd pay up to $125. With respect to microfiche, MLA members prefer positive to negative images, "Diazo over Silver paper," and the COSATI format (60 pages/fiche at the time of the report). Three factors stand in the way of micropublishing programs: Lack of standard formats and reduction ratios for microfiche; too few materials available on microfilm; no central clearing house for micropublisher/user information and interaction.

A series of studies at the Denver Research Institute found their way into the following publications:

James P. Kottenstette, *An Investigation of the Characteristics of Ultrafiche and its Application to Colleges and Universities,* Interim Report, Denver Research Institute, University of Denver, Denver, Colorado, August 31, 1969, 219 pp. Available from ERIC as ED 032 447 for 65c in microfiche and $9.87 in hardcopy.

Robert Grausnick and James P. Kottenstette, *Student Use of Classroom Microform in Support of a Survey Course, Phase I of an Investigation of the Environment for Educational Microform Utilization,* Denver Research Institute, University of Denver, Denver, Colorado, April 30, 1971, 41 pp.

James P. Kottenstette and K. Anne Dailey, *Student Use of Classroom Microform in Support of a Content Course, Phase II of An Investigation of the Environment for Educational Microform Utilization,* Denver Research Institute, University of Denver, Denver, Colorado, April 30, 1971, 84 pp.

James P. Kottenstette, "Student Reading Characteristics: Company Skill-Levels Demonstrated on Hardcopy and Microform Presentations," in *Proceedings of the American Society for Information Science, Vol. 6. Cooperating Information Societies,* Jeanne B. North, editor, Greenwood Publishing Corp., Westport, Connecticut, 1969, pp. 345-351.

Few papers deal with microform software design, preferring instead to attack the reading equipment. Two which suggest improvements in image layout and indexing are:

Wynn D. Crew, "Integration of Microfiche Publications into the Macro Library," in Jeanne B. North, editor, *Proceedings of the American Society for Information Science,* Vol. 8, 1971, Greenwood Press, Westport, Connecticut, pp. 241-245.

Wooster (first citation, this section). A summary of users' remarks on layout are: Documents being micro-

filmed should have no sideways layout or foldouts; tables, notes and references to the bibliography should be put next to the pages in the text referring to them; footnotes and subscripts should not be in smaller point type than the text.

* * * * *

A reading of the above references will present all the advantages and disadvantages microforms offer. In summary, microforms offer:

- Space savings.
- Access to complete back sets.
- Access to otherwise unavailable works.
- Ease of handling with the proper equipment and indexing.
- One-step copies of selected pages using reader-printers.
- Easier automatic handling (than paper) for information retrieval systems.
- Quicker availability for some series (versus hardcopy)—government research reports.
- Easier distribution and mailing.
- Inexpensive duplication (e.g., 25c for 98 pages versus $4.90 for photoduplication).
- Portability of large collections (e.g., several hundred microfiche reports and some types of portable readers can all be packaged in a briefcase).

The much-cited advantage of lower initial cost will be excluded here, since there are too many instances where the microform is the same price and even more expensive than a printed version. An unknown to the author is maintenance costs of microforms vs. printed versions.

Disadvantages seem to be:

- A reader is required (dependence on a reader is a real as well as a psychological factor. The author found that out when a bulb blew out at 1 a.m. with three fiche reports left to read).
- The readers aren't satisfactory (e.g., too expensive, not good quality).
- Many formats require many readers, or flexible readers, and a continuing education program for librarians.
- Reader-printers should be available for successful microform programs; most are expensive.
- Microforms are not books (can't make notes in margin; can't insert bookmark, paperclip, can't keep place while looking at tables, references).
- Visually one fiche looks like another (this is not to say that if you've seen one fiche you've seen them all!).
- Color isn't available as often on microforms.
- Available material on microform, though on the increase, is still limited.
- File integrity problems for fiche may require a "closed-stack" service.

SUBJECTIVE AFTERTHOUGHTS

Of the perhaps two hundred references scanned, perused and read in some depth for this paper, 22 were studied in microform–about 10%. (Before I counted them, I would have sworn that a full third were read in microform, attesting perhaps to their inconvenience.)

Documents were either 65c or 95c in microfiche (my kind of microform). In hardcopy, 17 were $3 or $3.29, one was $6.58, and three were $9.87. One was distributed free at a conference and was unavailable in hardcopy at the time I read it. Thus, for $16.35 I had a microform collection which would have cost $92.51 in paper copy. Of the 22 microforms, two were proceedings, four were equipment directories, three were bibliographies, four were user studies, and nine were reports on a variety of specific aspects of micrographics.

Economy was my primary reason for ordering microfiche in every case. In two cases, barring economics, speedier dissemination of microforms would have won out anyway. Space savings was a consideration for "going microfiche" to begin with, but doesn't seem to enter into individual decisions. There was not one report I would not have preferred to look at in hardcopy. Yet in retrospect, there is only one report I would have purchased in hardcopy–a directory which I scanned half a dozen times.

I found myself either so impressed with or engrossed in three reports with little application to this paper, that, in spite of myself I read them . . . in microfiche. Anyone unimpressed with bibliographies lately should take a peek at Frank B. Evans' *The Administration of Modern Archives: A Select Bibliographic Guide*, 1970, 220 pages, available from ERIC as ED 049 770 for 65c in microfiche and $9.87 in hardcopy. This is not recommended for microform reading, despite ERIC's $9.87 hardcopy price tag. Jessica Schar's 44-page report on the *North Carolina State Archives* is more palatable on fiche because of its size and makes fascinating reading on how not to run an archive, complete with interesting asides and commentary from her vocabulary of readings. And I've vowed to re-read *Report of the Task Group on the Economics of Primary Publication*, National Academy of Sciences, 1970, 252 pages–chock-full of interesting conclusions.

At least six reports I would put in the "Used Microform Exchange"–if there were such. The rest will find their way into my microfiche collection (of about 150 titles now). They reside in an easel-back 3-ring notebook–for titles with only one or two sheets–and a 4" by 6" metal box for trailer microfiche . For travelling I use a pocket-size notebook which holds up to 50 fiche. They're filed by accession number (e.g., AD, ED, PB) after scanning or reading. Before that they sit in an ominous pile on a bookcase and create pockets of guilt in my "professional" conscience. Since the collection is still small and since bibliographical information contained in the header portion of the fiche shows over the pocket each fiche is stored in, I haven't missed having an author/title index yet.

I use a "portable" (15 lbs., 20½-inches long, but not battery-operated) microfiche reader with this collection. During the past five years I've "ported" it about a dozen times, each time forgetting about it being long and me being relatively short–resulting in my crashing it against curbs and stairsteps. However, despite my clumsy treatment and two cross-country moves, packed by movers insensitive to the care of microfiche readers, I've only made one trip for maintenance. (The mirrors and the lamp housing had to be re-aligned–probably due to that last curb.)

The point I seem to be attempting to make is that in spite of all the bad things people say about microforms, there are advantages to using them and they can be used easily. In summary, I'm primarily interested in the content of a document, not its format. I do read the microfiche after purchasing it. I do enjoy the fact that 150 titles take up less than ¼ of one shelf of a bookcase. And last, I certainly intend to continue to buy reports on microfiche; it's the only way I can afford to read what I want as soon as I want.

A parting word about microforms versus microform equipment. I've never been disappointed in the performance of any but the oldest manual-loading reel microfilm readers–when they were working–but this is not to say there isn't room for improvement. At least specifications let you know what you're getting, which is not so with many microfiche (and microfilm). Two things are consistently bothersome to me about microforms: 1) poor quality microfilming, or microfilming from poor quality copy, is very hard on the eyes–perhaps 25% of the reports I receive have portions which are hard to read, 2) and, as detailed in user study after user study, the layout and packaging of documents on microfiche by publishers (more properly: microrepublishers) is neither geared to the microfiche medium nor to the needs of the user.

I like the idea of an index included on each sheet of a title in microfiche, though I would go the NMA standard one better and include the index to the complete work on each sheet, instead of just the index to that individual sheet. Footnotes (versus references which, if at the end of a work, might be on the next, or last, sheet), which I'd always considered passé, are now a preferred form of citation. My microfiche envelopes always end up with partial contents notes scribbled in my uneven scrawl–something I began to feel should have been provided in nice even print by the micropublisher. Though reformatting and bibliographic aids cost money, perhaps modest improvements wouldn't increase the total price by much.

I'd also suggest that academic and public libraries

advertise their reader-printers as they do their conventional copying machines. This would allow individual users to reproduce those few pages of text, statistics or references. Current microforms suffice, but a few small changes would increase the convenience factor manyfold and encourage, rather than discourage, the use of microforms.

Far from discouraging reading, the cheapness and availability of reports on fiche has encouraged acquisition and subsequent perusal of many more and a wider range of professional articles than otherwise would be possible. Other reading habits change with a fiche system too. Undisciplined readers (like myself) may prefer to read the captive fiche when the spirit moves them, versus reading a circulated hardcopy which carried with it time limits, easy browsing, and the inclination to mark sections for "later" reading.

Once the fiche reader has been set up (it's usually closed up and in a corner), blocks of time are devoted to reading. Somehow, the "inconvenience" of the reader imposes discipline.

A SELECTED GUIDE TO THE MICROGRAPHICS LITERATURE

At this point, it would be useful to gather some of the references sprinkled through the paper together with some yet to be cited. The intention is to provide a basic set of references which will allow deeper forays into specific subjects, as well as to present items which will serve as current awareness tools. Equipment and micropublication directories have been covered in previous sections.

Monographs

Watch for an announcement of a *Handbook on Conventional Microfilming* from the Superintendent of Documents–probably Spring 1973. Prepared by staff members of Dataflow Systems, Inc., it's being produced for the National Archives and Records Service, Washington, D.C. An introductory portion will serve as a primer on microfilm technology, followed by an evaluation of microform handling equipment (exclusive of readers).

Carl E. Nelson, *Microfilm Technology; Engineering and Related Fields,* McGraw-Hill, Inc., New York, 1965, 397 pp. A valuable reference despite its date; every aspect of microfilm technology is discussed. Though this volume is geared more to the production and use of microfilm products in an engineering environment, the sections dealing with readers and viewers and filing and storage equipment will be just as relevant for a library.

G. W. W. Stevens, *Microphotography; Photography and Photofabrication at Extreme Resolution,* John Wiley & Sons, Inc., New York, 1968, 510 pp. This is a comprehensive technical work on the processes of microphotography. One lengthy chapter is of particular interest. Chapter 12, "Microphotographic Reduction and Manipulation of Documents," pages 363-447 is broken down into the following sections: Input of Originals; Storage and Manipulation of Information by Microfilming; The Output; and a Conclusion and 96 references.

Allen B. Veaner, *The Evaluation of Micropublications; A Handbook for Librarians,* Library Technology Program, American Library Association, Chicago, 1971, 59 pp. (LTP Publication No. 17). Two sections comprise the contents of this cogent handbook. Part I "Micropublishing and Micropublications" provides the basics of microfilm technology. Part II "Evaluation Procedures," is the *raison d'etre* for the publication and is unique. The author provides a checklist for preliminary evaluation of a micropublication by investigating its promotional or prospectus information. Detailed sections on physical inspection of microforms, on viewer inspection, and on laboratory inspection follow. A classified bibliography of 54 references is included.

Bernard J. S. Williams, *Miniaturised Communications; A Review of Microforms,* The Library Association, London, 1970, 190 pp. A total of 354 references are skillfully woven together to provide a textbook/state-of-the-art specifically oriented toward library and information center applications ("communication systems" as the author puts it). Eight chapters cover: The terminology of microreproduction; some historical sources; microform formats and materials; library microtext systems; original publication on microform; information retrieval; evaluation of library hardware and standardisation.

Primers

A number of commercial micropublishers have published handy, brief, well-illustrated and free booklets about microform. The three below deserve special mention.

Franklin D. Crawford, *The Microfilm Technology Primer on Scholarly Journals,* Library Service Division, Princeton Microfilm Corporation, Alexander Road, Princeton, New Jersey 08540, 1969, 32 pp. Many useful facts are aimed directly at the librarian. This text is a very helpful introduction to the topic of micropublishing, although it could use vigorous editing and updating.

The Management of Information, Eastman Kodak Company, Business Systems Division, Rochester, New York 14650, 1972, 9 pp. Kodak's usual slick job of illustrating enhances this booklet which covers seven basic areas of microfilm (e.g., what is a microfilm system, how do you put things on microfilm).

E. Stevens Rice, *Fiche and Reel,* University Microfilms, 300 N. Zeeb Road, Ann Arbor, Michigan 48106, 1971, 21 pp. Definitions and brief explanations of films and formats are lucid and artfully arranged with a painless amount of UM promotion.

Annuals

Microfilm Source Book, Microfilm Publishing, Inc., New Rochelle, New York, 1972 edition, 164 pp. "Designed to be a single-source microfilm fact book that gives the sources of supply for every important service and piece of equipment related to microfilm. It tells who makes what, where they are, how to contact them." Partial contents: Keyword index; How to use The Source Book; 1971 Microfilm Year in Review; 1972-73 Calendar; Index to Products; Custom Equipment Manufacturers; Metrication; Index to Associations; Microfilm Bibliography; Index to Trade Names; Glossary of Microfilm Terms; 1971 Microfilm Stock Performance; Micropublishers; COM Bibliography; COM Service Bureaus; COM Services; COM Recorder Characteristics; Microfilm Service Bureaus; Guide to Consultants; Index to Sources; and Storage Centers.

Proceedings of the National Microfilm Association Convention, Vol. 1--, 1952--, National Microfilm Association, Silver Spring, Maryland. Some of the more provocative titles in last year's proceedings volume include:

Micropublishing in the 70's, Why Doesn't Everyone Use Microfilm?, Everything You Want to Know About Basic Microfilm and Have Been Afraid to Ask, The Spectrum of the Reader and Reader-Printer Industry, NMA Designs a Microform Research Library, New Directions in the Design and Operation of Technical Information Centers, and a sleeper entitled Micropublishing Market, which details the library microform market. (The reader should be cautioned that the *published* presentations listed above range from a title, to a summary to a full paper.) 1972 edition of *NMA Proceedings,* Vol. 21, 312 pp., Deborah D. Daly, editor.

State-of-the-Art Reviews

Lawrence Lessing, "Microfilm Emerges from its Dusty Corner," *Fortune,* August 1972, 5 pp. This very excellent article traces the history of microfilm and presents its present and potential uses for all microformats.

Carl E. Nelson, "Microform Technology," in Carlos A. Cuadra, editor, *Annual Review of Information Science and Technology,* Vol. 6, Encyclopaedia Britannica, Inc., Chicago, 1971, pp. 77-111. Over 200 references are drawn on for an overview of 1970 micrographic events. The 1972 edition, Vol. 7, was not to have a chapter on micrographics. The practice is scheduled to resume with the 1973 ARIST volume, when Hubbard Ballou will author *Microform Technology.*

Francis F. Spreitzer, "Developments in Copying, Micrographics and Graphic Communications," *Library Resources & Technical Services,* Vol. 16, No. 2, Spring 1972. Those micrographic events, products and literature items of 1971 and early 1972 which have an application in library systems are reviewed and analyzed. Over 100 references form the basis for this paper. Each year the spring issue of *LR & TS* carries a review. Past reviews have been written by Robert Sullivan and Allen Veaner.

Journals

Information & Records Management, Vol. 1–, 1967–, Information and Records Management, Inc., Hempstead, New York. Monthly, controlled circulation, free to most libraries. As the name implies, this publication covers more than just microfilm. Paper management is its other concern and paper-handling equipment is often featured. Each issue features at least one major article on microfilm equipment, systems of applications, plus a section on computer-output-microfilm. Presentations are simple, well illustrated, and directed to "the information handling professional."

Journal of Micrographics (previously the *NMA Journal*), Vol. 1–, Fall 1967–, National Microfilm Association, Silver Spring, Maryland, bimonthly, $20/yr. "Containing technical articles, systems and case studies, computer-output microfilm, scientific communications, standards, book reviews, notices and bibliographic notes, and other material of interest to the micrographic field."

Microform Review, Vol. 1–, 1972–, Microform Review, Inc., Weston, Connecticut, quarterly, $20/yr. (fiche or hardcopy), $30/yr. (fiche and hardcopy). Contents of issues typically include: Comment; MR News; 4-6 articles; 10+ reviews of micropublications; two book reviews; materials in simultaneous publication; recent articles on micropublishing; clearinghouse of library microform projects; and an index to reviews.

Microfilm Techniques, Vol. 1–, No. 1–, 1971, Microfilm Techniques, Inc., 250 Fulton Avenue, Hempstead, New York. As its subtitle, "The Magazine for Operational Microfilm Personnel," implies, this magazine is intended for those who process microfilm. As a sibling journal to *Information & Records Management,* it also features product surveys (e.g. splicers, silver recovery units).

Information Services, Newsletters, Current Awareness Services

INFORMATION, Part 1/News-Sources–Profiles, Vol. 1–, 1969–, Science Associates/International, Inc., New York, bimonthly, $25/yr. Contains news on products, grants, people, meetings, and literature, some of which are on micrographics.

The Microfilm Newsletter; A Monthly Report for Executives Who Use or Market Microfilm Services and Equipment, Vol. 1–, 1969–, The Microfilm Newsletter, Inc., New York, monthly, $40/yr. Jam-packed issues are known for their COM reports, company profiles, conference calendar, lists of selected microfilm stocks. Hotline reports, usually a page of "hot" news, are issued occasionally. As the subtitle implies, the slant is balanced between the industry and the user.

**MICROGRAPHICS News & Views,* Vol. 1–, June 1970–, Becker and Hayes, Inc., Los Angeles, semi-monthly, $75/yr, general subscribers, $60/yr, government or educational subscribers. Contains news on micrographics equipment, companies and personnel; features include guest editorials, book reviews, conference coverage and in-depth coverage of news, applications, and emerging technologies. Its attempt to present the user's viewpoint is reflected in its emphasis on libraries and micropublishing.

**Micrographics Weekly; A Comprehensive Management Report on Microfilm, Micropublishing and the Computer/Microfilm Interface.* Vol. 1–, June 1970–, Technical Information, Inc., Los Angeles, weekly, $75/yr; $60 for educational institutions. Calendar of events, stock summaries and news on all aspects of the micrographics industry. More useful for the industry executive than for the uninitiated.

Micro-News Bulletin; A Current Awareness Educational Publication, Silver Spring, Maryland, 1969, National Microfilm Association, bi-monthly, free

with NMA Membership. Current issues appear to be devoted to NMA news, committee reports, and international news.

*In December of last year, both of these newsletters ceased publication. *MNV* was absorbed by the publishers of *Knowledge Industry Report*, where occasional reporting of micrographics news will continue to appear. *MW* was discontinued, but micrographics news will appear in a sister publication, *Graphic Communications Weekly*.

Abstracts

Information Science Abstracts, Vol. 1--, 1966--, Documentation Abstracts, Inc., Philadelphia, bi monthly, $40/yr.; $25/yr. individual subscription. Section 5.4, "Microreproduction," conveniently gathers references to the micrographics literature.

NRC d Bulletin, The National Reprographic Centre for documentation, Hatfield, Hartfordshire, England, quarterly. Not only are a wealth of abstracts presented in each issue, but news and articles on micrographics are included--especially as they relate to the United Kingdom.

Glossary

Don Avedon, editor, *Glossary of Micrographics*, National Microfilm Association, Silver Spring, Maryland, 1971, $4.80 (MS100-1971). The standard glossary of terms used in the U.S. micrographics industry.

Standards

Micrographic Standards and Related Items, National Microfilm Association, Silver Spring, Maryland, 5 pp., May 1972, $1.50 or 25c if ordered with other NMA publications (MR1-1972). Designation (ID No.), Title, Price and Availability are listed for 78 specifications, standards, handbooks, recommendations and charts available from the National Microfilm Association, National Bureau of Standards, American National Standards Institute, Department of Defense agencies, International Organization for Standardization and others.

Sources of Information and Consultants

Buyer's Guide to Microfilm Equipment, Products and Services--1972, National Microfilm Association, Silver Spring, Maryland, Annual, Free! Consultants and their areas of expertise are listed.

"A Guide to Microfilm Consultants and Consulting Organizations," in *1972 Microfilm Source Book*, Microfilm Publishing, Inc., New Rochelle, New York, pp. 136-139. A brief introduction to choosing a consultant, costs and types of consulting jobs, leads into a descriptive listing of 34 consultants in the micrographics field.

Library Technology Project, American Library Association, 50 East Huron Street, Chicago, Illinois 60611 (312) 944-6780. Evaluative publications on microform equipment should continue to be issued for the next couple of years. The consulting staff, however, is gone.

National Microfilm Association, Suite 1101, 8728 Colesville Road, Silver Spring, Maryland 20910, (301) 587-8444. Brief question-answering service is provided.

Market Research Studies

No literature of a technology would be complete without mention of market research studies. Several features characterize these reports, which are also sometimes called multiclient studies: They reflect the status of the industry at the time of report issuance; they contain financial information on individual companies, on segments of the industry and/or on the industry as a whole; they contain analyses and forecasts; and they are relatively expensive (i.e. hundreds to thousands of dollars for the first copy). Two examples are the Frost & Sullivan Report on Micrographics and the Yerkes-Wolfe Study on Micropublishing.

* * * *

To order documents from ERIC, note the listed price, and enclose a check for that amount to the ERIC Document Reproduction Service, P.O. Drawer O, Bethesda, Maryland 20014. Always order by ED number. Individual Clearinghouses cannot fill these requests.

This paper is distributed pursuant to a contract with the National Institute of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under government sponsorship are encouraged to express freely their judgment in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official Office of Education position or policy.